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Engineering and Mining Journal

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To the Readers of

Engineering and Mining Journal

This issue of the Engineering and Mining Journal is printed and mailed in San Francisco, Pacific Coast headquarters of the McGraw-Hill Company. On pages 568-a and 568-b, you will find a statement of the necessity for this development.

Read Pages 568-a and 568-b

Through the courtesy of the Allis-Chalmers Manufacturing Company the space scheduled for their advertisement on the front cover of this issue has been released for the above announcement of the McGraw-Hill Company.

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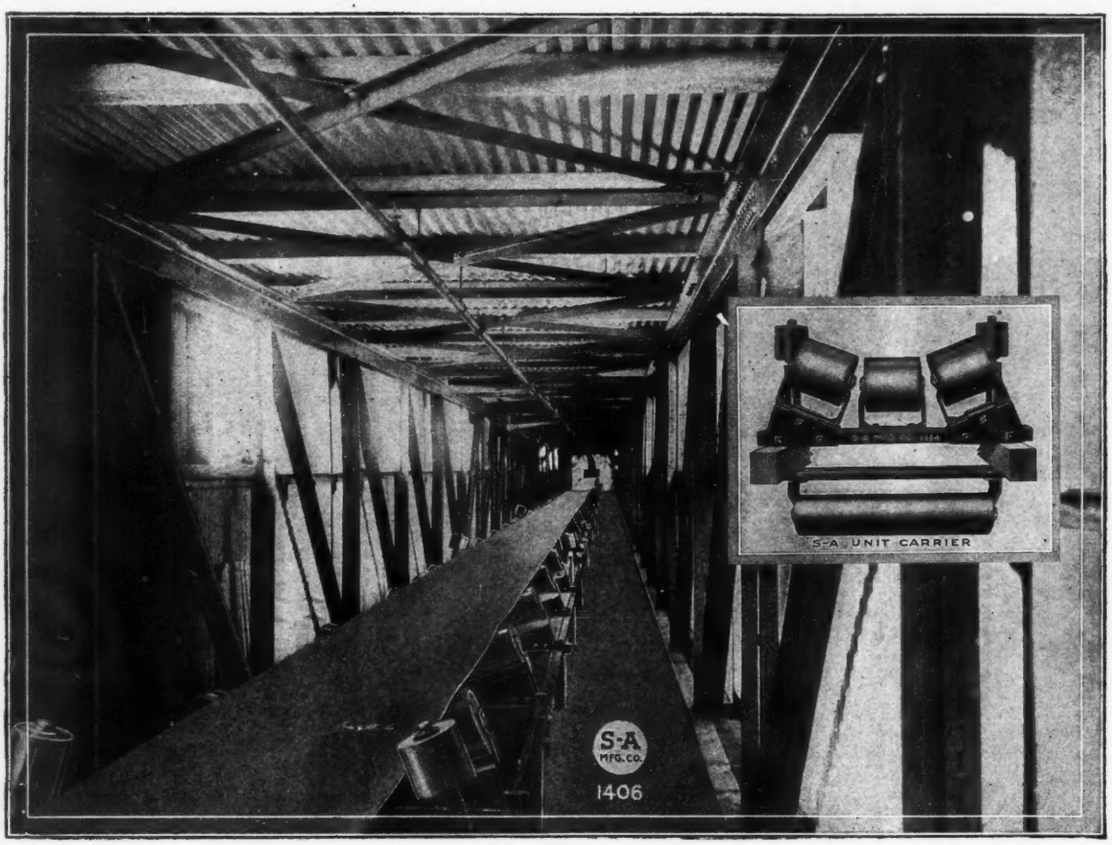

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To the Readers of Engineering and Mining Journal

An Open Letter

This issue of the Engineering and Mining Journal is printed in San Francisco, the headquarters of the Pacific Coast activities of the McGraw-Hill Company, Inc., of New York City.

The Journal, dated October 4, is delayed because of the printers' strike in New York City, about which our readers have already heard.

The strike is not yet settled.

The inter-factional fight between the unions is still preventing the publishers from meeting with any of the true representatives of the men who can take the responsibility for representing the men and make decisions.

The publishers have decided to act. They have decided to proceed with the printing of the papers in whatever cities they find possible, pending a settlement of the labor situation in New York. It seems apparent that the only way to bring sane thinking to the leaders of the radical element is to prove by publication that they cannot force the publishers to comply with their unreasonable demands.

The publishing of this number of the Engineering and Mining Journal is naturally attended with special problems. We believe our readers and advertisers will understand why it is not normal in all respects. But if this program for reestablishing completely the service rendered by the Journal meets with the same enthusiastic commendation from our readers that has followed our efforts to settle the strike on a basis of sound policy, we shall be repaid for the extra cost and effort involved. Never have we felt more in common with our readers than during these days when letters of helpful assurance have poured into our office.

Not least is a telegram from our contemporary, Mr. T. A. Rickard, Editor of the Mining and Scientific Press, who offered us the services of his press room on the Coast, an offer which, while we did not have need to accept, is none the less sincerely appreciated.

The next issue of the Engineering and Mining Journal for October 11, will be mailed from our San Francisco office as soon as possible.

When we undertook the expansion of our editorial and advertising organization on the Engineering and Mining Journal, we had no thought that so immediate an opportunity would come to prove the value of a strong organization, both in the East and in the West. It is only within the past two months that the McGraw-Hill Company, Inc., publishers of nine other journals, in addition to the Engineering and Mining Journal, purchased the Journal of Electricity of San Francisco, that making the eleventh publication in this group of engineering periodicals. This purchase of the Journal of Electricity was

a part of the plan to increase the resources and the service of the McGraw-Hill Company to readers and advertisers on the Pacific Coast.

Expansion of Engineering and Mining Journal Service

Editorial correspondents of the Journal are located in many of the principal industrial and mining centers. During the last year Mr. George J. Young has taken up work as Western Editor of the Engineering and Mining Journal with permanent headquarters in San Francisco, and many new correspondents have been secured.

The editorial direction and the development of broad plans for increasing the strength and importance of many features of the Engineering and Mining Journal have been placed in the hands of Mr. J. E. Spurr, as Editor-in-chief, who brings to his new work a wealth of experience from his many years in consulting engineering practice and his work in the Government bureaus associated with the mining industry.

American mining practice leads the world. American mining engineers are situated in every country. The Engineering and Mining Journal therefore has a world-wide opportunity for leadership, and it is particularly fitting that the leadership of the Mining Journal comes out of the best of thinking, not only in the East and the West, but in other countries.

The Journal is fundamentally American and yet it is international. It has followed the penetration of the American miner and engineer into foreign countries. It numbers among its readers a large percentage of other English speaking peoples, as well as many to whom English is not a native tongue. Its subscribers in foreign countries are one-third as many as those in the United States. It is interesting to note that outside of Canada and Mexico, Japan is more largely represented than any other country. We shall not fail to remember our obligations to our wide-spread clientele, nor fail to adopt the broad international viewpoint that has progressed even farther in industry than it has in the political world. At the same time we aim to represent most intimately the American mining industry in all its phases, from the activity of the miner and prospector to that of the great organizer. The Journal is absolutely independent of financial or other connection with any special interests in the mining industry, and purposes so to remain.

West Comes to Rescue of East

It seems more than a coincidence, it seems almost a recognition of the fitness of this great purpose, that the first test of it comes at a dramatic moment, when a strike has tied up the New York presses, and the West cannot only have a vehicle of expression in a national publication, but can literally come to the rescue of the East and print this issue of the Journal.

We feel a real sense of our responsibility to our readers. Our editors have a singular opportunity to be both a part of the industry and to see also industry as a whole. Leadership was never more needed in the world than now. We need sane thinking. We need the best ideas of the men in the West and in the East, in the United States and in the countries which have problems in common with the United States. We need sound editorial expression of this sane thinking, and it seems the special responsibility of journals of industry to report and interpret great movements in thought today in the language of industry.

The coordination of effort between East and West can help solve these great problems. Through this better understanding of the East in the West and the West in the East, our industry should present a united front to the engineering and mining problems of reconstruction which are occupying the minds of the thinking men of the industry.

The Publishers.

Engineering and Mining Journal

Permission to mail this special edition in San Francisco has been accorded the publishers by the Post Office Department.

Volume 108 | San Francisco and New York, October 4, 1919 | Number 14

Strikes

AS ONE picks up the morning paper today one unconsciously glances over the headlines for the latest news regarding strikes and to learn who is the next to announce that he will join the procession. To many it is merely a matter of curiosity, and they think little of the principles involved, unless they chance to come in personal contact with the results of the strike.

What difference does it make to the average reader in Kansas City whether the steel-works men strike or stay at work? It may be a long time before he feels any of the effects of such a strike, but he will feel them sooner or later, and learn that he has a vital interest in this and every other strike. In the same way, the miner may not at first see much connection between a strike in Pittsburgh and his work in the Anaconda copper mine, but there is, nevertheless, a very close connection.

A strike that calls out 2,000,000 men, or only a fraction of that number, from such an important industry as the manufacture of steel, is sure to affect that industry seriously, but the disorganization cannot stop within the plants that convert iron into steel. The closing of steel mills means less demand for pig iron, fuel, fluxes, and ore. It means the tying up of ships and the sidetracking of empty freight trains. It means the slowing down of iron-ore production and less money coming into the producing communities. A cessation of steel production means that the brakes must be set upon those industries into which steel enters as a principal or important element. What building or manufacturing industry is there which does not require steel in some form? The dynamo, the motor, and the trolley all call for iron and steel. The slowing up of such industries hits the copper market, and the Anaconda miner will then realize how a serious strike at Pittsburgh may touch his peace and happiness.

The miner is not in a class that is independent of other industries. He is more or less dependent upon every industry that influences the life of the community. He is more dependent upon the orderly progress of industry than is any capitalist, and he has more power than any capitalist to put a curb on strikes, although he has seldom used it. Some workingmen realize the interdependence of industries: that some cannot go on while others stand still. With the realization of this fact the sentiment against strikes will grow.

For example, when a steel strike is proposed, there may be expressions of sympathy for the object of the strike, but there will be also a protest from those whose labor is to transport and use the steel. There will be a protest from miners of ore, fuel, and flux. The protest will come from so many directions and from so many labor organizations that leaders will hear and heed those protests. We have faith in the belief that the miners will not be the last to raise their voices in the discouragement of all industrial strikes.

The Dawn of Sanity

THE age of lunacy that had its inception when Germany invaded Belgium has revealed how many there are of our fellow men that ought at least to be sent to the psychopathic ward of the nearest hospital for prolonged observation. The question of sanity is perhaps after all, a relative one. In the case of Germany it seemed as if the entire nation had lost the function of reasoning. There is no doubt that the Bolsheviks are either criminal or crazy.

But as the wave of unreason has swelled higher and higher, first in one country and then in another, at last sweeping over even our own country, the dawn of sanity seems at last breaking—and in the country where society first ran amuck. This is the case if a recent dispatch in the *New York Times* is to be believed. The German workman is undergoing a great change of attitude toward economic questions. Many now favor a reduction in the cost of living rather than higher wages and are advocating a ten-hour day, as against one of eight hours, as the only means of increasing production and easing the present hard conditions of living. Surely this is cheering news to us—to some of us at least. Even as socialism and perhaps bolshevism came out of Germany, let us hope that this new-old thought will overwhelm the world.

Mexico

THE *Journal* has been accused of following the lead of "the yellow daily press and agitating for intervention by the United States in Mexico," and it is further suggested that we would do better to cling to technical matters and leave politics alone.

As to "following the lead" of any press, yellow or otherwise, we plead not guilty. We have our own sources of information and endeavor to make accurate statements relative to conditions on the other side of the Rio Grande, whether that information leads to the conclusion that Mexico is capable of solving her own problems, or to the conclusion that it would be better for Mexicans and all other peoples that some one should lend her a helping hand. Many of our readers have concluded that we advocate military intervention because the elimination of conditions to which we have called attention seems possible in no other way.

As to eschewing politics and clinging to technical matters, it is quite difficult to draw the line as to what are and what are not political questions. It has been said that anything in which a large number of people are interested, or in which a small group of the public is interested, is a political matter.

If we should eliminate from our columns matter in which many are interested and devote them entirely to a discussion of technical subjects in which only specialists are concerned, we should fail in the fulfillment of

our objective. This is our excuse for frequent reference to Mexico—if, indeed, such is needed.

We have no enmity toward Mexico or the vast majority of Mexicans. We do not covet her riches or her undeveloped resources. We have but one desire—peace and happiness for the Mexican people. When this is an accomplished fact there will be no question of protecting the lives and property of foreigners. The latter will be as secure as the former, and no one can ask for more. If political and industrial conditions in Mexico are adjusted in the interest of her own citizens, her difficulties with respect to foreigners will begin to take care of themselves.

Mexico is potentially one of the richest countries in the world. It has every climate, from tropical to north temperate. The fertility of its soil is unsurpassed, and its backbone is a range of mountains stored with base and precious metals. We desire to see the potential become actual.

In recent years no ruler of Mexico has taken the presidential chair who has had the resources or following that would enable him to establish a government giving ample guarantee of law and order. For this reason only those industries that can stand a heavy tax have been able to do business at all. Among these the mining of gold and silver has continued at some points and the production of oil has increased. Other industries have led a precarious existence or have been entirely stifled.

The present incumbent is by no means lacking in ability, and he knows full well that present conditions cannot continue indefinitely. He also knows that the amount of taxes now collected is very large, but that it does not go toward the liquidation of indebtedness. By far the greater part goes to the support of a military organization upon which he cannot depend. It costs him more to maintain this organization than it does to fight.

Perhaps at times we have taken too gloomy a view of the Mexican situation. We would be glad to see some bright spots in it, and if those who are living on the further side of the Rio Grande will only call our attention to those things that go to make the high lights, we will be glad to give them prominence in the pictures we draw of Mexican conditions.

Wanted: Steel, Copper, and Coal

FOOD is not the only thing for which Europe is calling; her need for the product of our mines is as great as that for the products of our soil. Her demands for the output of the mines may not be as great as the latter, but the need is there, and the only reason she is not insisting upon their more extensive shipment is the fact that she has but limited means of paying for them. There is no need for the cultivation of a foreign market. It already exists. It is a seller's market, and there will be no haggling over prices, if only some means of paying can be found. This matter is primarily a banker's problem, but producers and operators are vitally interested in seeing that it is solved intelligently and quickly.

Though the United States is pre-eminently fitted to supply foreign markets with steel, copper, and coal there are many other products of mines and smelteries equally favored with an unsatisfied demand from abroad.

Although the market exists, ships will not carry our products to it unless they can return with one of three things: products of those countries, coin, or promises to pay. Except to a limited extent, the countries needing our metals are not yet producing; they cannot pay in produce. They have some gold, but they need that at home more than we need it here. The main thing they have with which to barter are their promises to pay, and the immediate question is, What shall be the form of these promises? What form shall they take to be serviceable to those who can furnish the desired products, but must have cash with which to conduct business?

It is not a matter of short-time credits such as Germany and England have used in the past to encourage foreign commerce; these our banks could furnish. The promises to pay that must now be given may mature years hence. Our producers and their bankers cannot carry such a load.

These credits must be established by the American people as a whole—not the Government of the United States but the people themselves—those who bought Liberty bonds, savings banks, life-insurance companies, the miner, the laborer, the banker, the poor and the rich. Savings from all sources must go into foreign loans just as they went into Liberty bonds.

While the war was in progress a fifth of our people loaned money to the Government, which promptly turned $10,000,000,000 over to our allies, that they might spend it in this country. The money was spent, and it was in this way that we managed to keep ships passing to the other side loaded with millions of dollars' worth of material, the fleets returning in ballast or only lightly laden.

Our post-war financial problem has changed but little. The demand for goods is not quite so urgent. The Government must pass over to its people the risks and opportunities of peaceful trading. We must take the bonds or promises of foreign countries or foreign firms without the guarantee of our own Government coming in between, and we must do this not for the benefit of foreigners but for our own good and convenience.

We have the means; we are the wealthiest people in the world—not boastfully, but in fact—but we need to be educated to the necessity and opportunity that lies before us; otherwise this potential market will not become a reality. This is not a political problem; it is not a moral obligation that should be fulfilled. It is purely a commercial proposition, but one in which we are all interested, whether we have nothing or have much to do with commerce.

The task that lies before us is hard, but not too great for a nation that has done what we have done during the last two years. The marketing and purchase of foreign securities in the United States is something new to our people, and yet it can be done. In the $10,000,000,000 that we have loaned Europe we have done this very thing, only that the United States guarantees payment of interest and principle. Now it is the part of investment bankers and those directly interested in production and export to show the investing public the advantage of foreign investments and virtually to guarantee their safety.

Already substantial loans have been made abroad, but they are small as compared with the needs of the various Allied powers, and our public has not yet been asked to participate in the purchase of the securities

corresponding to these loans. The investment trust seems to be the most practical agent for handling this business. Such a trust may investigate and loan to many branches of industry in large or small amounts, issuing its own securities with credit based upon all of the promises to pay. In this way the risk to the purchaser is reduced to a minimum and the premium paid by the borrower is as low as possible.

If at times the inquiries from abroad for the product of our mines seem light, it may be well for the producer or trader to ask himself a question: What am I doing to stimulate the market in the United States for foreign securities? As that market varies, so will foreign trade, and as foreign trade varies, so will domestic mineral production.

Sad Plight of the College Instructor

THE successful practice of the engineering profession in all its various branches rests upon the technical education of its members. Administrators may be born, and reach eminence in the management of engineering enterprises without the aid of college diplomas, but the engineering details are worked out only by those who have passed through schools of both theory and practice. Schools of theory have for years depended for their success upon the untiring devotion of a class of men who seldom attain eminence outside of their particular sphere of teaching.

If the world owes every man a living, as socialistic doctrine claims, it certainly owes it to the educators who have the responsibility of training our youth. It is an unpleasant truth that no ciass of workers receives less public attention, less credit, and less compensation for services rendered to humanity than college instructors and professors. This has been serious in the past, and lack of adequate compensation has forced many an able instructor to abandon that work for which he was temperamentally fitted, and has compelled him to enter the field of professional practice in order that he might support a growing family. Bad as this state of affairs has been in the past, it is far worse now, and the plight of many of our most efficient college men is serious.

The importance of engineering education to public welfare is so fundamental and far reaching that its neglect is more than serious—it is a calamity; and yet our thoughtless and unappreciative public is guilty of this very neglect today. Though the public, the mass of the people, receives the benefit from the practice of the engineering profession, few have a clear conception of the extent to which life and happiness depend upon its practice, and fewer realize the necessity of adequately supporting the source from which an engineer's usefulness is derived.

Within the last few months the American people have shown that they have some appreciation of the work of the public-school teachers, and have generously come to their support, but the instructors in the institutions of higher learning have been overlooked. This is not the fault of the boards of control, for the men composing these bodies know the conditions and would rectify them if they could. The colleges simply lack funds. They cannot pay their instructors the wages of longshoremen. Instructors must suffer or abandon their professions.

Although every college in the country appreciates the disadvantages under which its staff labors, Harvard, one of the richest institutions of learning, has been among the first to undertake a campaign to rectify the evil of an underpaid faculty. During the first week in October Harvard graduates will undertake an intensive drive for $11,000,000 or more, for an unrestricted endowment fund for the university. Harvard is only one of many institutions where the instructors in engineering have received only about one-third of the compenscation of competent locomotive engineers. We would not belittle the responsibility of the latter, but we would like to see the material appreciation of the former magnified to its proper proportions.

All engineers know the importance of keeping in our colleges able teachers of those subjects in which they have specialized, and it is now clearly the engineer's duty to put his shoulders to the wheel, and assist in every possible way in maintaining the standards of education that have been established. It will be a labor without compensation other than the knowledge of having done something worth while. We have faith that they will respond.

The Need for Propaganda Among the Uneducated

THAT education is one of the best solutions of the present industrial unrest is nowhere better proved than in the strike of the steel workers. Reports indicate that most of the native-born Americans were inclined to stick to their jobs and that the groups of strikers and trouble-makers were almost 100 per cent foreign. Although the American laborer has not enjoyed a liberal education by any means, he has had many more opportunities in this direction than the immigrant. The agitator finds his most fertile field to sow the seeds of industrial discontent in the uneducated masses from southeastern Europe, and the Bolsheviks thrive in darkest Russia. These people cannot see beyond their own noses, and fall easy victims to any one who will make the most extravagant promises regarding wages and hours of work. Under the present conditions, labor cannot harm itself more than to cut down production, and thus raise the cost of living, by striking. There are signs that the labor unions are waking up to this fact.

It is unfortunate for the country that more propaganda is not being circulated among the uneducated classes in an effort to bring before them some of the elementary principles on which the social order is founded. To say that the mill worker reads and hears one hundred reasons why he should try to get more pay or work shorter hours to one argument that he should produce as much as possible for the good of himself and the nation is hardly an exaggeration. Why cannot we have a little more Federal and state educational propaganda among the men who are now obliged to listen to the agitator or nobody? The speakers required must not be of the "high-brow" type; they must be taken from the ranks of the better class of workers, and their messages must be delivered in the halls which are frequented by the classes they wish to reach. Their bulletins must be printed in languages which can be read. How much progressive Americanism and sound economics are being printed in our country in the Slavic languages today?

Possibilities of the Oil-Shale Industry

Probable Extent of the Business Shown—Differences Between American and Foreign Practice—Relative Value of Oils and Byproducts—Commercial Methods of Retorting Already Developed—Refining Not Difficult

BY H. M. ROESCHLAUB
Petroleum Engineer, Denver, Col.

THAT the manufacture of oil from oil shale is destined to become one of the greatest industries in the United States is now a matter beyond dispute. The dominant position of oil in the industrial world today is a matter of common knowledge. The economic life of the country demands that this production be not only maintained, but actually greatly increased; also, considerable apprehension is now being felt in high sources as to the outlook from drilling operations.

In the latter part of May, 1919, an exceedingly pessimistic report by the U. S. Bureau of Mines was transmitted to the House Committee on Appropriations through Secretary Glass of the Treasury Department. This report states, in part, the actual conditions which cause the present apprehension pertaining to the oil situation, and sets forth the facts that the underground reserves of the United States are 40 per cent exhausted, and that domestic production from drilling is probably near the peak stage; that the consumption of petroleum is increasing far more rapidly than the domestic production; that the oil contained in the vast reserves of oil shale is not yet available; that petroleum has become the fundamental basis of the industrial and military life of the nation; that gasoline has become the motive power for approximately 6,000,000 automobiles and trucks, for airplanes, farm tractors, motor boats, and numerous other industrial purposes; that fuel oil has become necessary for our navy, our merchant marine, and larger industrial plants; that the potential supplies of crude oil outside of the United States are rapidly passing almost entirely into the political and economic control of foreign governments; that the United States is thus likely to pass from the position of dominance into a position of dependence, and that in 1918 the United States imported 39,000,000 bbl. of oil, in addition to using from our reserve stock about 27,000,000 barrels.

It is estimated that the demand on the oil industry will reach about 800,000,000 bbl. per annum by 1927 and that all known and probably all underground reserves will become entirely exhausted by 1928. It is therefore apparent that some other source of oil must be found and that immediate preparations must be made for its development in order to supplement the present source. That the oil shales in the several Western states will constitute this new source is recognized by both Government officials and petroleum experts; in fact, these shales are considered of such potential value that the Government has reserved a total of over 132,000 acres, of which 45,440 acres are in Colorado and 86,584 acres are in Utah, as a naval oil reserve.

LEDGE OF PAPER SHALES LYING NEAR TOP OF MOUNTAIN

SCOTCH SHALES

Considerable publicity has been given the oil-shale industry, during the last year, setting forth operations abroad and the enormous industrial possibilities in the United States. Scotland appears to be the foremost country in this industry at this time. There, oil and several valuable byproducts have been obtained from shales for over seventy years, during which time the industry has been paying enticing dividends, in spite of

the comparatively high mining costs and slow processes of eduction. Scotch shales produce an average of around 25 gal. of oil per ton, together with a considerable quantity of ammonium sulphate, 50 to 60 lb. per ton, by far the greater portion of which is exported, principally to the United States and Japan, where it is used in commercial fertilizer.

United States Shales

In Colorado, Utah, Wyoming and Nevada there are enormous bodies of oil-producing shales, which will give, upon distillation, from two to three times the oil per ton that is obtained from Scotch or other shales abroad, together with a marketable amount of ammonium sulphate. They will not, however, produce as much ammonium as do the foreign shales; but it is estimated that the commercial shales in these four states will produce many times the oil that has been and will be obtained from oil sands within the United States.

Oil Contents and Value

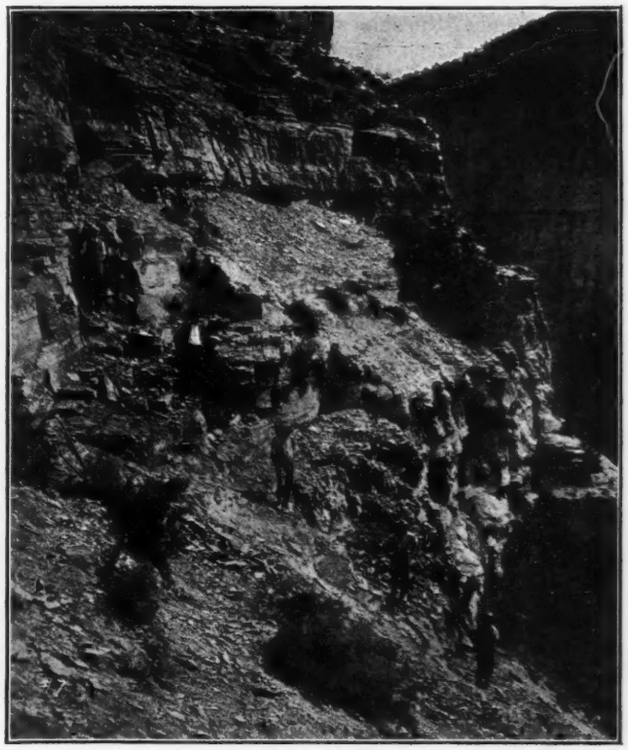
Though the U. S. Geological Survey states that the oil-bearing stratum in Colorado averages 1,500 ft. thick, it is not reasonable to assume, of course, that this entire area is commercial shale. The strata of commercial shales—that is, shales capable of producing around one barrel of oil per ton—have been variously estimated to range from thirty feet up to several hundred feet in thickness, but a safe estimate would be fifty feet. This would mean that each acre contains 110,000 tons of commercial shales, capable of producing that many barrels of oil upon proper distillation.

Physical Conditions

These shales lie in high mountains rising for many hundreds of feet above the surrounding country. A considerable shale area is accessible by well-built roads, and the country contains, readily available, all the necessary timber and water for operating purposes. It must be taken into consideration, however, that by far the larger portion of this vast area is not now accessible. This section contains numerous deep canyons, from the sides of which the shale can be readily distinguished, but many of these canyons have no outlet by which a shipping point can be reasonably reached, and the shales cannot, therefore, be considered of commercial value at this time. There are, however, several main streams well back into the shale area which make available for immediate operation sufficient commercial shale to meet all operating requirements for some years. The same conditions exist in Utah, Wyoming, and Nevada, so that it can be readily understood that no apprehension need be felt regarding the insufficiency of commercial shale. Practically all of the accessible shale lands, however, have been acquired by right of location and are now held by individuals and companies as vested rights. No shale land of commercial value is now available for further location in so far as my investigations have disclosed.

The location of the shales above the valleys will make the mining and transportation to the retorting plants economical and workable on a large scale, with a smaller outlay for equipment than is required abroad. Another advantage is that, the shale beds being exposed, the tonnage and oil content of any given area can readily and quickly be ascertained at a nominal cost, something after the manner of computing the contents of a large timber tract, which condition permits the placing of the reduction plants at the most advantageous points.

Though Utah has a larger area than Colorado, it appears that the strata in Colorado are larger (they lie in blanket or flat formations), and carry a better average oil content. Wyoming also has a larger area than either Colorado or Utah, but the strata there are much smaller and carry less oil content than either Colorado or Utah. Nevada also has commercial shales, in a more limited area than either of the states mentioned, but they are rich in places and in good workable veins. The Nevada shales also carry some phosphates, which is not a commercial content of the Colorado or Utah shales. In both Colorado and Utah gilsonite is also found in the shale fields, together with a brown formation much like gilsonite, which should be of considerable commercial value. There are at a number of points small veins of elaterite, but in most instances too small to receive attention from a commercial standpoint.



TYPICAL FORMATION OF COLORADO OIL SHALES

These shales, known as the Green River Formation, contain no liquid oil, and are, therefore, not susceptible to evaporation, nor is the oil capable of being educed by the use of solvents. What they do contain is an unfinished hydrocarbon, which requires the application of heat in a manner permitting the eduction process to be carried out. This is chemically termed destructive distillation, and is not a complicated process, but is one that can be accomplished in a number of different ways.

Destructive Distillation

The fundamental principles to be taken into consideration in successful distillation (retorting) of oil shales are that when the hydrocarbon shales are heated, the oil is expelled from them as a boiling liquid; that the heat must be maintained at the proper temperature to vaporize this liquid for removal from the retort; that the normal temperature of these oil vapors is 305 deg. to 310 deg. F., and if they are allowed to remain in the retorting chamber after volatilization, and their tempera-

ture be raised in an appreciable degree, they will be converted into a permanent or fixed gas which could not be condensed and therefore would cause a loss of oil. The amount of the oil vapors thus converted into a permanent or fixed gas will be governed almost entirely by the style of retort used and the length of time required for the removal, at their normal temperature, of these oil vapors into a cooler atmosphere. At all times the distillation should be carried on at the lowest temperature consistent with the complete eduction of the oil and its conversion into vapor, and in this manner the maximum amount of oil will be obtained and the minimum amount of permanent gas. Though a certain amount of permanent gas will inevitably be produced, any excess over the minimum will necessarily be at the expense of oil recovery.

There is no question that the oil from some shales can be educed at a lower temperature than others, though some of the shales may require a longer exposure to the heat. These factors must be carefully taken into consideration and determined regarding the specific shales to be handled. The first eduction stages will be reached at a temperature of around 150 deg. F., and this should be gradually increased until a maximum temperature of approximately 700 deg. F. is attained, at which point practically all of the oil will have been educed, with the possible exception of a small part of the heavier and less valuable constituents, which may require a higher temperature for vaporization to remove from the retort. Their value, however, hardly justifies the time and extra heat necessary for their recovery. The lower the temperature at which the oils can be educed and vaporized, the better the grade of crude that will be obtained, and a consequent larger proportional recovery of gasoline will result.

The operating conditions abroad and in this country will differ in several material ways. Abroad there is a nearby market for all the permanent gas produced, it being used for domestic purposes, a condition which will not exist in American shale areas. There, a fuel is used for retorting purposes which is entirely foreign to the shale; and mining is done mostly by hand-drilling, and a considerable per-ton expense is entailed in bringing the shales from the beds underground to the retorting plants. Scotch and other foreign shales are in comparatively small strata and irregular in formation, which creates a high operating expense chargeable to each ton of shale retorted.

In this country practically the reverse of the conditions noted will prevail. The gas produced will probably be in excess of the amount required for retorting purposes, with no available market. The mining will be done with machine drills, either electric or compressed air. American shale beds lie well up in the mountains, permitting the use of gravity in delivering the shale to the retorting plants; and the shales here are found in much larger strata, permitting a cheaper breakage of the shale. And though the wages in this country are undoubtedly more than they are abroad, the conditions here will probably result in a cheaper per-ton cost.

In Scotland and elsewhere abroad the primary objects of operations differ from those which will prevail in this country. The industry has been carried on there primarily for the recovery of the ammonium sulphate, with the permanent gas the secondary objective, and the oil recovery has always been merely of subordinate consideration.

It is apparent that a retort in which the shales enter at their normal temperature in a continuous stream, and while being passed along are continually stirred (to prevent fusing) and are from time to time brought in direct contact with the heated walls of the retort, with gradually increasing heat until they have reached the final eduction temperature desired, when they are ejected, would constitute the most economical method of distillation. A matter which must be taken into consideration is the fact that if the shales of the United States are allowed to lie dormant in the retort during the eduction period, they have a tendency to become fused or matted, and are therefore difficult to remove. In several experiments along this line it has become necessary to blast the spent shales from the retort. They must be kept moving at all stages of the eduction period to achieve satisfactory results.

What is required in this country is a simple retort which can be economically and easily constructed, giving a reasonable tonnage per day, designed primarily for the recovery of the oil and embodying none of the complications, either in construction or operation, of a retort of which the principal function is the recovery of byproducts. Such a retort will obtain a certain percentage of the attendant byproducts, but not the maximum, and will undoubtedly be found to be the most profitable system of operation on American shales. If it should be desirable to obtain the maximum of ammonium sulphate, it would be more feasible to construct a retorting plant along special lines to handle the shales primarily for this purpose, but such a retort would be much more complicated, both in construction and operation, and also more costly than one built for oil recovery as its principal objective.

Permanent Gas

Western American shales, when heated to a temperature ranging up to 700 deg. F., will ordinarily produce from 2,500 to 3,500 cu.ft. of permanent or fixed gas per ton, in addition to the oil vapors. This could be materially increased by raising the temperature of the vapors, but at the expense of oil. This gas contains approximately 450 B.t.u. per cu.ft. It will require from 350,000 to 500,000 B.t.u. to retort one ton of shale under ordinary conditions, depending to a large extent on the style of retort and efficiency of the heating arrangement. If only 50 per cent efficiency is obtained, it will require from 1,400 to 2,200 cu.ft. of gas per ton of shale to produce the requisite heat for eduction purposes for the recovery of the oil, assuming the maximum temperature at 700 deg. F., and it would, therefore, appear that there will be ample gas for retorting requirements, with a sufficient excess to generate the necessary steam power for all operating purposes. Should the production of permanent gas be found not sufficient, however, the shale itself can be readily used for heat generation, and will be found a cheap fuel, although special arrangements will be required for its use.

One of the peculiar features of the permanent gas production is the fact that the lower-grade shales, those producing from 10 to 20 gal. of oil per ton, will produce appreciably more gas than is obtained from the richer shales, although it does not appear that the very rich shales, those producing around 100 gal. of oil per ton, vary to any great extent in the amount of permanent gas produced from those shales yielding around 40 to 50 gal. of oil per ton. The lower-grade shales also appear to burn as readily, and apparently produce as

much heat, if not more, than the higher-grade shales, when burned under proper conditions.

Mining will not be found to be a complex problem. It has been suggested many times that oil shales can be mined by steam shovel or open-cut methods, but though there may be a few isolated localities in which these methods would prove practicable, the principal processes of obtaining the shales for retorting purposes will be somewhat in the manner of coal mining with the room and panel systems, or by stoping, as is done in metal mining. The shales will be found in wider strata than is customary either in coal or metal mining, and the mining can therefore probably be done more cheaply.

Western American shales lie in flat or blanket formation, and where compressed air or electric drills are used, some difficulty may be encountered with seams if straight drifting on the veins is undertaken, more especially on what are termed the paper shales. It will, therefore, be found more advantageous to drill the veins at an angle, which will also give a better breaking effect from the powder.

MASSIVE SHALES IN COLORADO

At almost any point in the shale area, veins of from six to twenty feet in thickness, carrying a commercial oil content, can be found. These can be economically worked by running in either on the bottom or immediately below the vein and removing the vein matter by means of inclined stopes. The drilling can be done at an angle across the vein, and the shale can be broken into a loading chute, from which it can be drawn into cars for tramming to the crushers, without hand shoveling, thereby greatly reducing the cost of this operation.

CRUSHING

During the early stages of the investigations, the question of crushing caused considerable apprehension, on account of the pliability and lack of fracturing qualities of the shales. It was found that rolls were too slow for practical work, that ball mills would not do at all, and that there are a number of other crushing machines which are not adaptable to oil shales. There are, however, several mills which give the desired results. These are embraced in the rotary-hammer type, or the pan mills, of which there are a number of types from which to make a selection. It may be necessary, in order to increase the capacity of the crusher proper, to first pass the shales through a jaw crusher, thereby reducing the pieces from man-size to several inches before passing to the fine crusher.

BYPRODUCTS

The question of byproducts to be obtained from the oil recovered from the shales, as well as the spent shales themselves, is a much mooted subject. A number of statements have been made as to the great number of byproducts to be obtained. Probably most of them came direct from an encyclopedia. Although there appears to be no question as to the practicability of obtaining several valuable byproducts, such as ammonium sulphate and fertilizer, the facts must be taken into consideration that different temperatures and methods of conducting the shales through the retorts will not only produce varied byproducts, but varied characters of the same byproducts, and it would therefore be folly to attempt to make any statement even approximating accuracy with respect to them. There is no question that a number of byproducts can be and have been found, in laboratory work, but the industry has not progressed sufficiently to justify the assumption that any number of them can be obtained commercially.

Though the more valuable oils are recovered from the shales at temperatures ranging up to 700 deg. F. and as rapidly as this temperature can be reached and maintained, ammonium sulphate, probably about 10 lb. per ton, will also be recovered. However, to obtain the maximum amount of this product, it will not only be

necessary to construct an entirely different style retort than one primarily for oil recovery, but the temperature must be carried to a minimum of 1,300 deg. F., and possibly as high as 1,600 or 1,800 deg. F., together with the injection into the retort of super-heated steam, to convert all the nitrates into ammonium sulphate. In order to accomplish this it is necessary to free the shale of all carbon, which requires an intense heat. The process is, therefore, much more complicated than the simple recovery of oil. It is questionable whether the price and marketability of this product would justify the necessary expenditure for the special retorts and additional operating costs necessary for its recovery in maximum amounts. The life of a retort used for this purpose would also be materially shortened.

Flotation

The matter of using the residue shale oil, i.e., that remaining after removal of the gasoline and lighter lubricants, has been seriously considered, and the fact that several well-known engineers give it their unqualified endorsement as a flotation oil speaks well for its future use in this field. It must be remembered, however, that the demand is limited, only about 500,000 bbl. now being used per year. When many companies are producing shale oil, and trying to dispose of their residue oil for flotation purposes, the market will probably be flooded. Undoubtedly, however, the entire supply could be used for this purpose for several years, during which time other industrial uses can probably be discovered.

Fertilizer

One of the promising fields for byproducts at present appears to be the utilization of the spent shales for fertilization purposes, as they contain from 0.5 to 6 per cent of nitrates and small amounts of potash and phosphoric acid. If this can be worked out on a commercial scale, considerable additional revenue should be derived from this source.

Precious Metals

Analyses of the spent shales from the Colorado area are said to have shown recoverable gold, silver, and platinum, but these mineral values undoubtedly came from a very small area, as the general formation and nature of the shale bedding would not indicate that these metals could be found in commercial quantities, and they should not at this time be given serious consideration.

Refining

Though crude shale oil may differ somewhat from the crude produced from oil sands, and probably will require a slight deviation from present refining methods, the refining should not be a complex problem. When the methods are once determined, the refining of shale oil will be as readily accomplished as that of ordinary crude oil.

The expenditure necessary for refining shale crude and the construction of refineries for that purpose will not differ materially from ordinary refining, and such expenditure will be based entirely upon the finished products into which the crude oil will be manufactured. Should it be found practicable to work the residue oil into a flotation oil by merely removing the gasoline and lighter lubricating oils, both construction and operating expenses will be comparatively small, but if it be desired to obtain the paraffin and heavy oils and greases, a larger expenditure, both for construction and operation, will be required.

Shale-oil gasoline and lubricants are at least equal in every way to those products obtained from the oil sands. The shale oil should, and in most instances probably will, crack into around 50 per cent gasoline, of a quality equal to that of the commercial gasoline now obtainable.

American Methods

As already stated, the process of treating the shale is simple destructive distillation, and the efforts of American engineers so far have been devoted for the most part to mechanical efficiency. This involves the handling of the shales through the retort in a continuous and automatic manner; keeping them moving at all times to prevent fusing; bringing them intermittently into contact with the walls of the retort for the required heating; immediate removal of the oil vapors from the interior of the retort without raising their temperature; reasonable running capacity commensurate with installation costs; as nearly perfect heat efficiency and control as possible; the continuous and automatic ejection of the spent shales from the retort, and, finally, a reasonable installation cost and minimum operating expense.

Several purely American methods are now available which incorporate these mechanical requirements to such a degree as to justify the installation of retorting plants. Several of them have been tested on a sufficiently large scale to prove their efficiency for commercial operation.

I wish, however, to put forth a word of caution, as several of the American methods which have been tested have been found inadequate or imperfect. Great care should govern the selection of the method to be used, as an error in this particular will cause considerable delay and additional expense.

The recovery of contained products from American shales is purely a mining and manufacturing industry, with vast quantities of raw material readily available at a cost only of taking it, which will be comparatively small. The new shale should yield about one barrel (42 gal.) of crude oil per ton. A favorable feature is the fact that the necessary plants, both retorting and refining, can be constructed with no danger of an exhaustion of the supply of shale. When once these plants are installed, their production should be without material fluctuation for many years, possibly for several generations, and though it will require a reasonable amount of capital to embark in this industry, it is by no means such an enormous amount as to be prohibitive, nor will it be as great as many industrials require the earnings from which are much less and more speculative than the oil-shale industry.

The certainty of the production of oil on a commercial scale with an unquestionable market for the product should appeal to capital and relieve to a considerable extent the speculative features. That the time and conditions are now right for the exploitation of the Western oil shales on a large scale is a matter which appears to be beyond question.

One of the Richest Gold Pockets which has been found on the continent occurred in the Croesus Mine, in northern Ontario, where a yield of about $85,000 per ton was obtained. Six samples of this ore, valued at $10,000, were purchased by the Ontario government.

Geology of the Gogebic Range and Its Relation To Recent Mining Development—Part IV *

Deeper Mining Shows Greater Extension of Orebodies—Conservative Estimates State Ore Depth To Be 4,000 Ft., and Dependent on Extent of Water Circulation, Which Is Effective Agent in Altering Iron Formation to Ore

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THE ore deposits of the Gogebic Range may be classified either according to the mode of origin or according to their form. Based on mode of origin they are divided into (1) those originating chiefly by the leaching of silica from some part of the oxidized iron formation, and (2) those which owe their existence chiefly to the erosion of iron formation and the segregation of the iron oxide by this process. This last class is not important and includes only certain rich beds in the Pabst member—the so-called "fragmental ore zone"—and similar bodies found east of the Sunday Lake fault, where pre-Keweenawan erosion cut into the iron formation and worked it over, washing out much of the decomposed chert and leaving local deposits rich in iron oxide. The only case of this Keweenawan ore which I have seen is in the Sunday Lake mine.

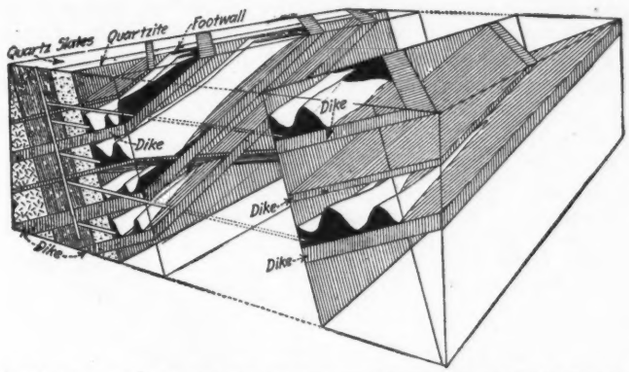


FIG. 26. BLOCK DIAGRAM SHOWING RELATION OF OREBODIES TO DIKES AND THE GREAT BEDDING FAULT

The orebodies in the Pabst fragmental zone are usually thin and of limited extent. They give way on all sides to less well-assorted material, which makes the main mass of this member. Orebodies of this class are influenced little, if any, by dikes or faults, and are likely to be found just as wide and rich below a dike as above it.

In the first class, those derived from oxidized-iron formation by the leaching out of silica, belong all the main productive orebodies of the range. These may be derived from any part of the iron formation, as any of it may alter to ore under favorable conditions. Usually, however, these orebodies are confined to five horizons in the Ironwood formation. This is discussed in detail later under "Influence of Various Beds on Localization and Form of Ore Deposits."

Classified according to form, the orebodies again fall into two divisions; (1) those having a flat tabular form with the two greater dimensions parallel to the beds and the least dimension across the beds; and (2) those having a very long axis—sometimes two or three miles—parallel to the foot wall and dike trough in which they lie, and relatively short dimensions at right angles to the long axis. The flat tabular orebodies include the fragmental ore deposits in the Pabst member and also numerous small orebodies in the Ironwood formation.

The form and mode of occurrence of the orebodies which occur in dike and foot-wall troughs is evident from Fig. 26. For the sake of clearness, this has been drawn as though that part of the formation north of the great bedding fault were bodily shoved north to permit seeing behind it. From this figure it is apparent that the orebodies follow down the pitching troughs, and that an orebody found at the surface in one place may be found at great depth in an adjacent property. These orebodies may be described as great inclined spindles. In many cases they taper off at each end and are largest in the middle. Some of them extend from the surface to the greatest depths that mining has penetrated them. Others are entirely underground and do not appear at the surface. One of these last is a Puritan orebody shown in Fig. 27. A general idea of the vertical cross-section and vertical longitudinal projection of such an orebody is given in Figs. 28 and 29. From these figures it is seen that the longest dimension in the cross-section is usually parallel to the foot wall.

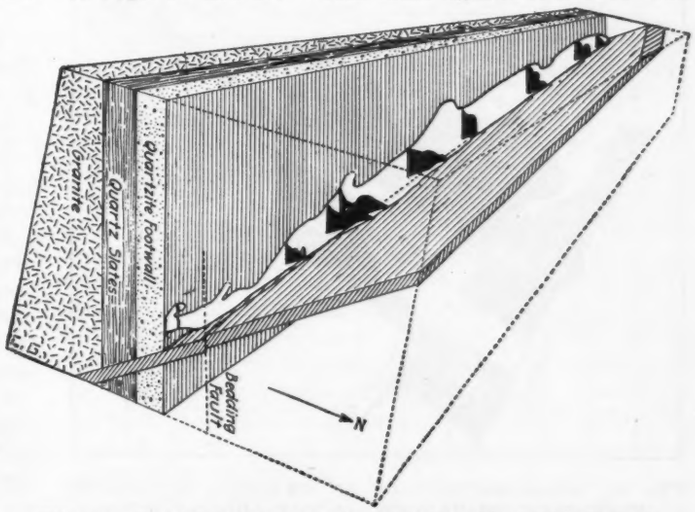


FIG. 27. BLOCK DIAGRAM SHOWING FORM AND MODE OF OCCURRENCE OF AN OREBODY IN THE PURITAN MINE

The top of this diagram is deep below the surface. The orebody pinches out at both ends

The depth to which these orebodies go is not known. Mining has extended to a depth 2,500 ft. vertically

*Parts I, II, and III were published in issues of the *Journal* of Sept. 13, Sept. 20, and Sept. 27, 1919, respectively.

from the surface, and nothing has been found to indicate the stoppage of conditions favorable to the development of orebodies. In fact, it is the general history of the range that the deeper that mining has gone the larger have been the orebodies. Predictions as to the ultimate depth at which ore will be found are worth little. It is conservative, however, to estimate that ore will extend at least to a depth of 4,000 ft.,

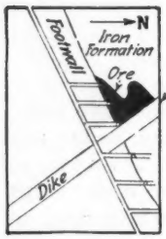


Fig. 28

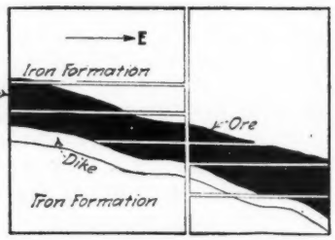


Fig. 29

FIG. 28. CROSS-SECTION SHOWING RELATION OF A TROUGH OREBODY TO FOOT WALL AND DIKE

FIG. 29. LONGITUDINAL SECTION OF PART OF A TROUGH OREBODY, SHOWING RELATION TO DIKE

and it will be surprizing if it does not go considerably deeper.

The form of the orebodies and the depth to which they extend depend upon the depth to which vigorous water circulation has extended. The structural factors controlling water circulation were discussed under "Alteration of the Iron Formation," and there listed as foot walls, dikes, faults, physical condition of beds—porosity—and folds.

One additional factor enters to control the depth to which the formation has been altered to ore, that of the slowing up of the water circulation by depth.

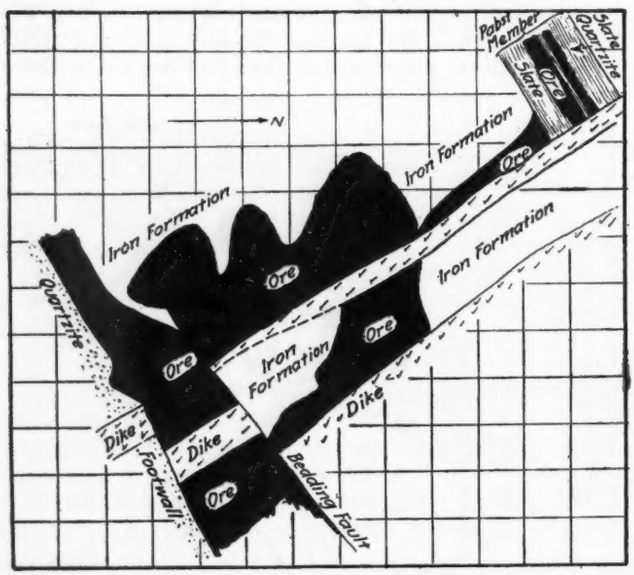


FIG. 30. CROSS-SECTION OF AN OREBODY EXTENDING FROM FOOT TO HANGING IN THE AURORA MINE

The first five factors undoubtedly continue to vastly greater depths than profitable mining can go. The effect of the last can be told only as deeper exploration discloses the facts. The slowing up of the water circulation should not be considered on the basis of present relief of the surface and present climate, but rather on the relief and climate of the geologic times, just after the beds were tilted to their present positions. Then the relief was greater and the water circulation more vigorous, on account of the greater hydrostatic head. The climate of those times was also much more arid than at present, and the water table consequently relatively lower, so that more of the formation was doubtless above the permanent level of the ground water and subject to the action of an abundance of oxygen.

INFLUENCE OF VARIOUS BEDS ON LOCALIZATION AND FORM OF ORE DEPOSITS

The porous or impervious nature of the iron formation, and the amount of the iron oxide originally present, are facts which relate themselves to particular beds and structural conditions. Some beds are relatively very porous and permit ready circulation of water. Others are tight and impervious, and the circulation of water is relatively impeded. Some beds contained much iron originally, and some little. Some are porous and had much iron in them. Others are porous and contained little iron. Some are tight and

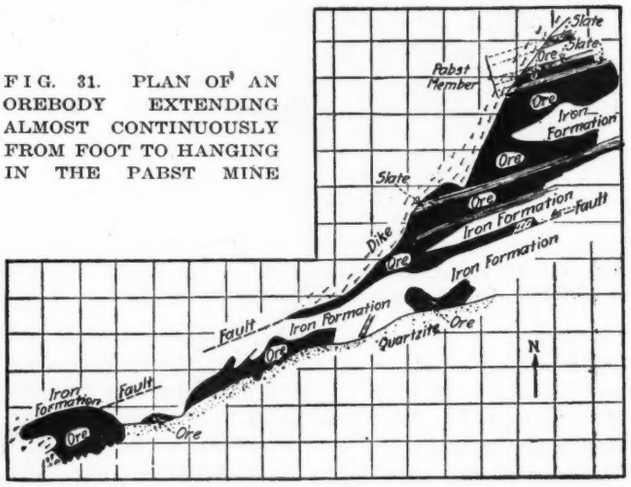


FIG. 31. PLAN OF AN OREBODY EXTENDING ALMOST CONTINUOUSLY FROM FOOT TO HANGING IN THE PABST MINE

had much iron, and others are tight and had little iron. These characteristics of the beds may be tabulated as follows:

1. Porous with high original iron content.
2. Porous with low original iron content.
3. Impervious with high original iron content.
4. Impervious with low original iron content.

In similar structural situations beds of these types are altered to ore in the order given. It must be borne in mind that any part of the iron formation is capable of alteration to ore, but it is obvious that a tight, lean bed will be the last to be so completely altered.

In the most favorable situations the whole formation from foot to hanging is altered to ore on a dike. Such an orebody is shown in Fig. 30, which shows a vertical cross-section in the Aurora mine. In plan an orebody of this sort has the appearance shown in Fig. 31, which shows part of one level in the Pabst mine. It will be noted that the "capping" of slightly leached iron formation is irregular in form. Certain beds project down between tongues of ore. From the discussion that has preceded it is obvious that the reason for this irregular form of the orebodies lies in the differing character of the beds. Those beds that are leanest and tightest project farthest

into the ore; those that are richest and most porous have altered to ore to the greatest distance above the dike.

The orebodies shown in Figs. 30 and 31 are characteristic of the largest bodies, in which the alteration of the formation has been most extensive. If one go to the opposite extreme and select the smallest orebodies that have been mined one finds that they are subject to the same conditions. Looking at Fig. 30 and imagining the pendant tongues of "capping" extended downward till they reach the dike, and so cutting the large orebody into several small isolated bodies, will give a correct picture of the way in which the smaller orebodies occur.

Alteration of the iron formation began first in the most porous beds where they were just above dikes large enough to control the water circulation. The porous beds that contained the largest percentage of iron, and so the smallest percentage of silica, were leached soonest of their silica, and were the first to be altered to ore. As this process continued, the

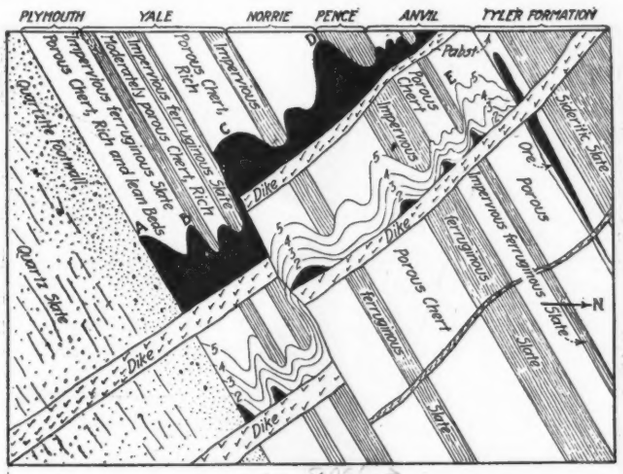


FIG. 32. CROSS-SECTION SHOWING FINAL FORM (ON UPPER DIKE) AND VARIOUS EARLIER STAGES (ON SECOND DIKE) OF AN OREBODY EXTENDING FROM FOOT TO HANGING

Black is ore

amount of material altered to ore increased, so that the orebodies grew larger and larger, until, in the most favorable situations, the leaner and tighter parts of the formation which at first separated the orebodies were finally altered to ore, and the orebody extended from foot wall to hanging, as shown in Figs. 30 and 31.

A series of cross-sections might be drawn showing this progressive enlargement of the orebodies, or it could be shown on a single section, as in Fig. 32. In this the whole thickness of the iron formation is indicated. The small black areas on the second dike down indicate the first parts of the formation to be altered to ore. The numbered lines outside this indicate outlines of the orebody in the successive stages of its development. The black area on the upper dike shows a cross-section of the final stage, that represented by line No. 5 on the second dike.

Fig. 32 shows also the various members into which the iron formation is divided. This section is not an actual section from any mine, but is a composite to illustrate the principles governing the form and occurrence of the orebodies as seen in cross-section. In any actual section the relative thickness of the various members would vary from that shown.

In the Wisconsin end of the range, where it has been most closely studied, there are four chief ore-producing beds or horizons. In the order of their past record of production, these would rank as follows in Wisconsin:

1. The basal part of the Plymouth undoubtedly has produced more ore than any other horizon. This is shown at *A*, Fig. 32.
2. The upper part of the Plymouth has probably produced the next largest amount of ore, as large foot-wall orebodies have always included this horizon when they became thicker. This is shown at *B*, Fig. 32.
3. The horizon of the great bedding fault has probably been the third most productive in Wisconsin, as practically the whole production of the Atlantic and Iron Belt mines came from this horizon. This is shown at *C*, Fig. 32.
4. The horizon of the top of the Norrie and base of the Pence has to date probably produced least, but it bids fair to take third if not second place in importance, as the Montreal hanging orebody lies in this horizon. This is shown at *D*, Fig. 32.

In Michigan, another member of the iron formation becomes of great importance, the Anvil member. It contains the new large hanging-wall orebodies of the Colby, Yale, Ironton, Anvil, and others. This is shown at *E*, Fig. 32. As it is a thick member, relatively porous and high in original iron content, it is practically a certainty that many other large orebodies will be discovered in it.

Further north than the orebodies of the Anvil member come those of the Pabst member of the Tyler formation. There are thus six different principal horizons at which separate orebodies are found:

1. In the lower part of the Plymouth member.
2. In the upper part of the Plymouth member.
3. In the bedding fault horizon—either in the Yale member or basal part of the Norrie.
4. Near the contact of the Norrie and Pence members.
5. In the Anvil member.
6. In the Pabst member.

Small orebodies have been found in other horizons, and as exploration extends some of these may prove to have considerable importance locally.

Unfortunately, time has not permitted sufficiently thorough study of the Michigan end of the range to identify with equal certainty the stratigraphic position of the orebodies there, but from the observations made it is clearly apparent that the orebodies occur in nearly, if not exactly, the same horizons as in Wisconsin. It is to be expected that their relative importance is not the same, and each mine should be studied carefully in relation to its own history and in relation to neighboring properties to see which horizons north of the foot wall have given the greatest amount of ore in the past and which offer the most promise for the future.

INFLUENCE OF FAULTS ON LOCALIZATION AND FORM OF ORE DEPOSITS

In the immediately preceding part, the influence of porosity and original iron content of various beds of the formation on the form and occurrence of orebodies was explained. It was illustrated with cross-sections, as these show the chief effect of these factors; and as these factors are characteristic of various

beds it might be expected that ore would be continuous along these favorable beds, but it is found that the orebodies are not continuous. They bulge and then pinch out gradually, or they come to an abrupt end against rock. Certain parts of the formation seem to be barren and entirely unleached, and even almost wholly unoxidized. In mine workings the formation above a certain dike is often found to be altered to ore, though between that dike and the next one below, possibly 200 or 300 ft., the formation may be slightly oxidized. Between the second dike and the third, still farther down, the formation may again be oxidized and leached, and contain ore. Not only are there alternate barren and productive parts in depth, but along the strike of the formation some parts are productive and some are barren.

These facts are due to the general conditions, before stated, which control the water circulation. They are not attributable to original differences in the beds, but, in large measure, result from the effects which the faults have produced in the circulation of the underground water.

Owing to the slight throw in the foot wall which many of the transverse faults show, they have not been regarded as important, and most of them have doubtless not been recognized at all. Only within the last ten years or so has the great bedding fault been generally accepted as an important factor in localizing ore deposits. These two types, the bedding fault and the transverse faults, are present everywhere along the productive part of the range, and so have been of greatest influence.

Both types of faults cut across all dikes and displace them, more or less, so that the impervious troughs made by the dikes and the foot wall are broken, and the water finds its way down the faults to deeper parts of the formation.

The transverse faults have permitted water to have ready access to certain thin, unusually porous and rich beds of the formation almost regardless of dikes, and in this way have been responsible for some if not all of the thin blanket type of orebodies along the foot wall. They also are frequent causes of "bulges" in the long "trough" orebodies. The increase in water circulation which reaches the trough where such a fault crosses it, particularly when the throw is not sufficiently great to completely separate the ends of the dike, causes greater activity in leaching of the silica. This results in an enlargement of the orebody. Cases are not uncommon where a transverse fault is followed up or down for long distances by a chimney of ore in the broken material of the shear zone.

The longitudinal fault has broken up the formation and permitted ready channels of flow for water. Where this water comes to a dike and flows along it, leaching of silica occurs, and if the process goes far enough an orebody results. The water in some instances spills over the edge of a large dike into the fault and is caught on the dike below on the foot-wall side. Orebodies of the form shown in cross-section in Fig. 33 are developed in this manner.

In addition to the effect on specific orebodies, of which the above statements are instances rather than a complete discussion, the faulting has had the more general effect of shaking up some blocks of the formation, and so making them more porous. Possibly, also, it has compressed other blocks, and so decreased their original porosity. In the movements that have taken place in the formation, those blocks of formation lying between dikes and between traverse faults have most probably acted as units. They can be regarded as the individual gigantic stones making up a great piece of masonry. As this "masonry" was tilted and settled and sheared, the resulting stresses on the individual units would break some of them and possibly compress others; some would be made more porous and some less so. The effect of this action cannot be observed; it can only be deduced from a mechanical consideration of what must have happened when the formation was faulted. However, it serves to explain why certain blocks of the formation contain ore and others do not; why between one pair of dikes there is good ore and between the next pair there is none, and why an orebody extends a certain distance along the strike, and the same beds which carried the ore are utterly unleached a few hundred feet farther along the strike. This mechanical effect on the various blocks of the formation cannot be foretold at present. It simply

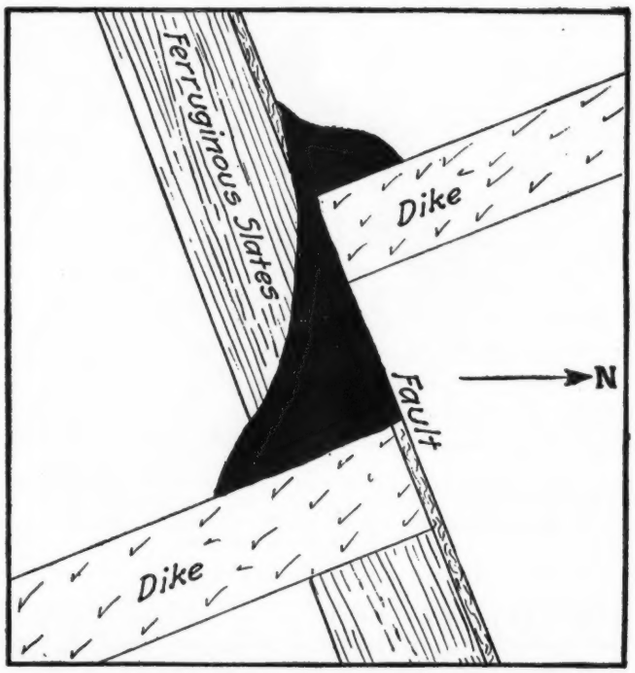


FIG. 33. CROSS-SECTION SHOWING AN OREBODY DEVELOPED ALONG THE GREAT BEDDING FAULT

aids in understanding the facts after they are discovered.

In concluding the discussion of the origin and occurrence of the ore deposits, it may be well to summarize the matter briefly. In form the orebodies are long, spindle-shaped bodies, or flat tabular bodies. They are found chiefly in six different horizons, but any part of the iron formation may alter to ore. The principal factors controlling form and localization are: First, the character of individual beds, porosity and original richness in iron; second, the structural factors, dikes, foot wall, and faults; and, third, the topography and climate of the geologic time just after the formation was tilted to its present conditions. All these controlled the water circulation, which has been the effective agent in altering the iron formation to ore.

Most of the exploration on the Gogebic Range is done by underground work, the driving of drifts and

crosscuts. Though this is the most expensive method, it is much more satisfactory than drilling, for the reason that it gives thoroughly dependable samples. Drilling is both difficult and expensive, owing to the much leached, vuggy character of the formation in the productive part of the range. The most satisfactory method of exploration is a combination of drilling and underground work.

From the preceding discussion of the occurrence and origin of ore deposits it is obvious that properly planned exploration should aim to test the best of the promising ore horizons on dikes of sufficient size to control the water circulation effectively. If the positions of transverse faults are known, it is best to explore in their vicinity. If the positions of dikes are known, crosscuts can be started to reach them at the desirable horizons. The usual method has been to run a crosscut straight across the formation, more or less blindly, in the hope of intersecting an orebody. If such a crosscut finds an orebody, it is purely a matter of luck. It may miss an orebody with great ease. Furthermore, it may never approach anywhere near a dike, and so be wholly wasted as effective exploration.

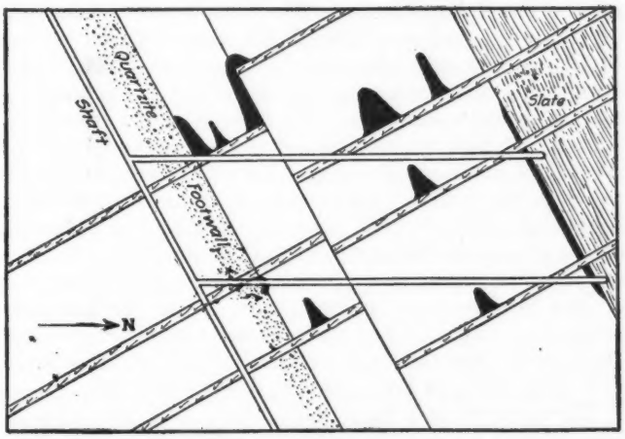


FIG. 34. CROSS-SECTION SHOWING TWO EXPLORATORY CROSSCUTS AND THE EASE WITH WHICH OREBODIES CAN BE MISSED BY PROMISCUOUS EXPLORATION EVEN WHERE OREBODIES ARE UNUSUALLY NUMEROUS

Black is ore

The way in which such a crosscut can miss ore is indicated in cross-section in Fig. 34. This figure is drawn to show orebodies in all six of the best horizons and yet show how two crosscuts can miss practically all of them. As such crosscuts are expensive, and little has heretofore been known as to real objectives for them, relatively few have been driven. The obviously necessary percentage of failure has been such as to discourage effective exploration away from the foot wall.

Fig. 35 shows the plan of the orebodies on one level with a straight crosscut, which does not explore the dike except for a small part of its extent, and that in an unproductive part of the formation. This figure also has been drawn to show orebodies in all six horizons on this one level, a case that would rarely occur, and yet it is evident that it is easy to miss all the ore north of the foot wall.

The best direction to run an exploratory crosscut is parallel to the dike. If any ore exists, it will be found. If the dike is not pitching, it can be tested by raising up to the dike from below or running an inclined raise parallel to the dike. It is evident from Fig. 35 that if a crosscut were run along the dike every orebody shown would be found. Furthermore, every foot of such a crosscut would be valuable exploration. It would disclose whether other horizons, in addition to those already known, were ore bearing, and it would exhibit the effect on the formation of the ore-forming, silica-leaching water, in the most favorable situation possible—where it has been concentrated on a dike. If each dike of ore-bearing size were tested by two or three such crosscuts, few orebodies of minable size would be missed.

It will be noted that in the foregoing discussion it was assumed that the position of the dike was known. If the positions of the dikes are not known—the usual case in exploration—the first problem is to locate them. For this purpose the drill is entirely satisfactory and cheapest. Holes inclined northward parallel to the formation, and drilled in pairs so that one is north of the fault and one south, are best for this purpose. Once the dikes are located it is relatively easy to plan underground work or surface drilling to crosscut the formation and explore the larger dikes at points where they intersect the horizons most favorable for finding ore. In later exploration for orebodies a single vertical or cross-cutting hole can sometimes be planned to test favorable horizons on several successive dikes.

It may seem at first thought to be an unwise expenditure to "explore for dikes," but when it is recalled that the ore is found lying on these dikes and at six or more different horizons in the iron formation the importance of knowing just where the dikes lie is obvious. It is the first essential to successful exploration.

Difficulties of Satisfactory Diamond Drilling on the Gogebic

Diamond drilling for ore is likely to be very unsatisfactory on the Gogebic Range. The formation is not uniform. It is vuggy, and soft in spots, and hard and dense in others. Faults, and the broken ground associated with them, are abundant; and even though in many cases they displace the formation but a few feet, they have broken the ground. In formation of this character it is exceeding difficut to get reliable samples. The water and sample may be entirely lost in vugs or in open ground. If the hole is drilling in ore after having penetrated a soft, leached ferruginous chert, the drill rods will

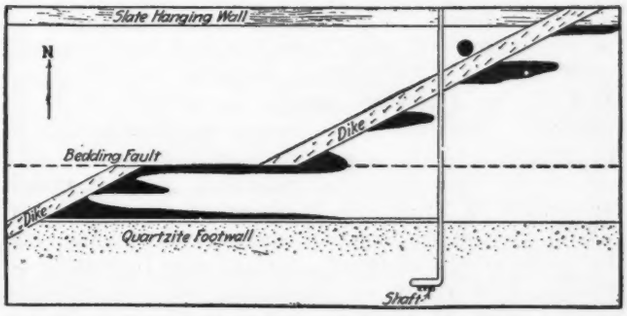


FIG. 35. PLAN SHOWING AN EXPLORATORY CROSSCUT AND THE EASE WITH WHICH OREBODIES CAN BE MISSED, EVEN WHERE UNUSUALLY NUMEROUS

Black is ore

wear off the decomposed chert from the sides of the hole and contaminate the sample. In more than one case that has come to my attention this contamination has been sufficient to take away any impression that an orebody had been penetrated. These are some of the difficulties of diamond drilling. There are many others, such as the necessity for carefully casing close to the bit, trouble with caving ground, reaming, cementing, and all the obstacles that occur in connection with the mechanical operation of drilling.

Notwithstanding all these difficulties, drilling is an absolutely essential method of exploration on the range. Some of them have been mentioned to bring out the difficulty of interpreting the results. Extreme care is necessary, and a full record of every fact in connection with the drilling of the hole, i.e., how many feet per day, amount of sample recovered per foot in each run, loss of water, caving, sticking bits, hardness or ease of drilling—in short, all that the drill runners learn of the nature of the ground, and all that can be obtained from careful study of the samples recovered—should be recorded. In this way often it can be correctly estimated that a 48 per cent assay from the sludge will be minable ore when a drift gets into it. In general, it may be stated that the results of drilling are likely to represent the iron content of the material penetrated as somewhat lower than it really is.

The most satisfactory method of exploration is to use the diamond drill to locate the most promising parts of the formation and then get into these by underground workings.

Many Future Discoveries Probable

The foot wall may be said to be fairly well explored, as deep as mining has gone in almost every property on the range in so far as these workings have extended. There are large areas, both east and west of the productive portion, that offer excellent promise for the future. Another element of great promise for the future consists of the possibility of further discoveries, (1) along the foot wall between areas that have been mined; (2) away from the foot wall; (3) in greater depth. It is my belief that exploration of the formation well away from the foot wall has only fairly started. Many large orebodies doubtless remain to be discovered north of present foot-wall workings. The success of several mines in finding in the hanging as large or larger orebodies than they ever had on the foot will lead ultimately to a thorough exploration of the whole thickness of the formation.

With unexplored foot-wall areas, greater depth, and the unexplored "hanging" part of the formation to develop, this range is reasonably sure to produce several times as much as it has in the past before final exhaustion of its high-grade ores.

The Troublesome Ruble

"I finally got through Siberia, but it was some stunt, and I certainly was glad I had no Government expense account to worry over, even with the Bureau of Mines auditor to help me," wrote H. Foster Bain, of the U. S. Bureau of Mines, from Shanghai last August. "How would I ever have made a motor car at 800 rubles for the afternoon look reasonable? But if I had not had the car, one of us never would have found a place to sleep the first night. Also, the rubles varied in value from day to day, and there were three different kinds to worry over aside from the counterfeit. The latter was so common that no one took account of it for bills of less than 100 rubles. I bought my first rubles with yen, having bought the latter with pounds credit in London, and having no idea what the pound will be worth in New York, say in three months from now when the draft turns up. I got ninety rubles for ten yen. These proved to be Romanoff rubles, and while in the stores, restaurants, and shops they pass only at par, after spending part of them I discovered that speculators would pay 150, or 50 per cent premium, for them in exchange for Omsk rubles, which are as good as any at the eats places, so I sold what I had left. Then I bought more Omsk rubles at twenty and at eighteen per yen. Then I got more from the bank at 165 per pound—about thirty-three per dollar—(the street rate was forty-six per dollar). They paid me mainly in 500-ruble notes, and nobody would take them because of lack of change. The cashier could not or would not make change, and I narrowly escaped having to adopt the native custom, and go swimming without a bathing suit. In that case, by taking up a collection of the change in the party, including the ladies, disaster was averted. Mainly we bought change, bargaining for it like potatoes and paying from 10 to 30 per cent premium. Meanwhile, rubles continued to fall until the last day my assistant was in Harbin, when he could have obtained 140 for a real honest-to-God dollar.

"Now, with this as a background, ask the auditor how a man should charge up a meal that cost sixty rubles? Oh, yes, there is one more complication. Occasionally, we could work off a United Cigar Store coupon as part payment at some variable sum. There was an explosion, though, one night in a restaurant when Kinney had landed one on a waiter. He reasoned it must be American money, and gave it in change to an American Captain. The Captain was no sport, but went right up in the air. The waiter was firm that whatever it might be "Amerikansky," it was "ten rubles our money," and we snook before the row ended.

"There are some compensations even for trouble with rubles. Yours for peace and sound money."

Increase in Steel Corporation Orders

Unfilled orders on the books of the United States Steel Corporation, Aug 31, were 6,109,103 tons, compared with 5,578,661 tons on July 31, according to *Iron Age*. This is an increase of 530,442 tons, against an increase for July of 685,806 tons, and an increase for June of 610,545 tons. The unfilled orders a year ago were 8,759,042, or 2,649,939 tons more. The table below gives the unfilled tonnage for the Steel Corporation at the close of each month beginning with January, 1916:

UNFILLED TONNAGE OF U. S. STEEL CORPORATION

	1919	1918	1917	1916
January	6,684,268	9,477,853	11,474,054	7,922,768
February	6,010,787	9,288,453	11,576,697	8,568,96
March	5,430,572	9,056,404	11,711,644	9,331,001
April	4,800,685	8,741,882	12,183,083	9 829,558
May	4,282,310	8,337,623	11,886,591	9,937,791
June	4,892,855	8,918 866	11,383,287	9,640,459
July	5,578,661	8,883,801	10,844,164	9,593,592
August	6,109,103	8,759,042	10,407,049	9,660,357
September	.....	8,297,905	9,833,477	9,522,584
October	.....	8,353,293	9,009,675	10,015,260
November	.....	8,124,663	8,897,106	11,058,542
December	.....	7,379,152	9,381,718	11,547,286

The largest total of unfilled orders was on April 30, 1917, when it was 12,183,083 tons. The lowest was on Dec. 31, 1910, when the total was 2,605,747 tons.

CORRESPONDENCE AND DISCUSSION

Letters From the Mining and Metallurgical Industry Dealing With Pertinent Subjects of Interest

Pulverized Coal at the Tennessee Copper Co.

The article on pulverized coal in the blast furnace, published in the *Journal* of Aug. 16, is interesting, and a discussion of it may prove much more so if some of those who have tried coal will tell their previous and probably unsuccessful efforts to use it as a blast-furnace fuel.

In 1910 or 1911 one of the many Japanese engineers and metallurgists who visited the Tennessee Copper Co. at that time asked if any attempts had been made to substitute coal for coke at the company's plant. He told of its use at one of the larger copper-smelting plants in Japan, the one with which he was connected, and described the method used there. After leaving Copperhill he wrote a short description giving a sketch of the apparatus that had been developed, and stated the percentage of coal that was required, which, as I remember, was less than 4 per cent. His results were so interesting that it was decided to make a simple trial in one of the blast furnaces at Copperhill. This was done, but the coal interfered with the color of the acid made from the furnace gases, and it was decided to postpone the work at least until the production of acid had been brought up to a reasonable quantity and the consumption of niter brought down.

It is probable that the experiments were not taken up by the new management, but, no doubt, the extreme prices of coke current in 1916 or earlier induced new experiments resulting in the success since achieved.

The method practiced at the Japanese furnaces, and which was tried first at Copperhill, was not to use powdered coal but fine coal up to pieces about 1 in. in diameter. The powdered coal was screened out, as I remember, and the coarser pieces were charged through the tuyère. This meant that the coal, on being blown into the furnace, did not burn completely as soon as it reached the hot interior of the furnace, but lodged in the interstices and burned slowly. A small amount of coal was charged intermittently, but on account of its slow burning gave no chance for back-firing or explosions. Eighty-pound air was used, as that was the only air easily available for the experiment. The tuyères soon brightened up, instead of being dark and cold, and the results seemed satisfactory. It was tried only on one or two tuyères and was used on different tuyères with the idea of doing away with the great amount of tuyère punching that had been found necessary to insure the fast running of the furnaces and the high grade of gas that was desired at the acid plant.

It was not practicable to continue the hand screening and charging of these small amounts, and so the tests were again postponed to some future time when operations should become normal, after completion of the bedding plant and additions to the acid plant then under construction.

This reminiscence is given, not with any idea of detracting from the excellent work carried through by Mr. Cavers, but to show that once in a while even Americans get valuable ideas or suggestions from the Japanese.

It was recognized that the blast furnace was not an economical apparatus for smelting, because the heat balance showed that there was sufficient heat from the reactions to do the smelting without any fuel, such as coke or coal. The trouble was that the heat was generated too high up in the furnace and the tuyère zone was too cold. Much of the heat from the coke and the sulphur is generated so high up in the furnace that it is almost valueless for the smelting operation and simply superheats the gases, which have to be cooled before going to the acid plant. By the introduction of and the burning of the fuel lower down in the furnace, the heat is obtained at the point most needed, which is the reason why a smaller amount of fuel will do the work.

It is particularly interesting to note that a charge as low as 12 per cent sulphur has been smelted with coal replacing part if not all of the coke, as this indicates a much greater field of endeavor than the semi-pyritic work at Copperhill.

It is also particularly gratifying to me to feel that another important advance in the art of metallurgy owes at least part of its beginning to the boys at Copperhill.

N. H. EMMONS, 2D.

Camp Wabasso, Laconia, N. H., Aug. 19, 1919.

The Engineer in Politics

Again engineers are reminded editorially in the Aug. 16 issue of the *Journal* of their political and civic shortcomings. Granted that the criticism of the profession as a class is warranted, individually (as this editorial must be interpreted) is it?

Let us follow the engineer from his inception in the business until he attains some measure of success. At college he is taught that his is the career which depends for its success upon individuality, force of character, and constant application to his work. His curriculum is technical. His instructors are technical. The whole atmosphere created in his particular department of training is technical. If his nature is one which absorbs this techno-culture, he spends his evenings at home alone, loading up on all the theory that his textbook provides, so that in class and laboratory he can make application of the principles he has acquired. He has not the time to take part in athletics that his classmate in liberal arts has; his course requires more hours to graduate from the four short years of training allotted for the groundwork of his calling. He gets a "corking" good course in mathematics because he needs that in his mechanics.

Chemistry is important, for it is so essential to get

the right combinations in the metallurgical laboratory and to pass examinations involving calculation of blast-furnace charges. Mineralogy must become second nature with him if the undergraduate engineer wants to be a geologist. He must be accurate. He must be exact and exacting (especially with respect to himself). His English ought to be correct, for otherwise it *might* spoil some future report; but he is supposed to have learned that subject at high school, and it would be unwise to neglect the technical subjects in college for history and literature, except, of course, to read the "technical journals" in idle moments. Sometimes he is counseled to take a "year" in Spanish, because there is a possibility he may be called to a job in Latin America, but that is not absolutely essential, as he can "acquire Spanish in the field."

Political economy and sociology the student recalls in some vague sort of way, perhaps because of the economy part. He has to practice it as well as hear it so much that it becomes the one great principle he gleaned from college life. Theatres, dances, social clubs are all right in their place, but during the college semester, nay-nay! They take time from study and make him sleepy during the lecture on the Dikelocephalus Period of the Lower Paleozoic (or is it the Upper?). Debating societies are good, in fact, fine in their way, especially if the discussions are on technical subjects. But then, the liberal art students get the most out of them, for they usually argue current topics, which don't help a fellow much when it comes to sampling a mine. Anyway, those fellows are studying to be lawyers and need to cultivate talking.

Again, does our embryo engineer ever hear a lecture on the benefit a workman derives from his union or that it is a good idea for the boys in the class to organize and hang together or deal collectively on such matters as might affect their welfare? Under such conditions our young engineer completes his college work and enters the profession to be put in full charge of a No. 2 shovel in a narrow stope by an ambitious and plodding superintendent who received his first practical experience in the same way.

Now the engineer discovers that there are other things to be learned than the subjects he thought he had mastered in college. Besides the practical knowledge which he acquires by time only, there is the business side, which somehow the "profs" overlooked. After shift he has to turn in and study accounting and system. The camp in which he launches his career is perhaps isolated. There is not much social life, and he has become more or less of a recluse anyway. If he was not studious at college he must work now to make up for the time he lost there. During the next fifteen years, if he has force and good judgment, he rapidly progresses along these lines (shifting to numerous places) until he is mine or mill foreman, or perhaps in exceptional cases he may have attained the superintendency of some prospective mine in Podunk or another equally well-known location. He at last has time to take a long breath, to sit down and reflect and to investigate the other fellows around him.

It is probable that the engineer now finds that Bill, who took liberal arts, is U. S. District Attorney in some lively city, where he settled after leaving college. He has acquired a large circle of influential friends and a comfortable home. Tom, who was always a good fellow and just got by with his general-science studies, also scraped through "medical," joined several of the prominent clubs in the city of a half million people; stayed there; became generally liked for his happy personality and charitable deeds, and is now favorably endorsed for Congress, with the solid backing of his medical associates, who seek much needed reform in laws affecting health and social welfare. So with the other fellows who entered their various lines of work at the same time he did. They settled down to a business, settled on a ranch or settled in some professional capacity in growing or populous communities. At any rate they *settled.* Then he inventories his own qualifications for public office. He finds in himself, as compared with the average 100 per cent public official, the following:

	Per Cent.
Age	100
Mentality	150
Judgment	200
Executive ability	300
Morality	100
Popularity with public	30
Popularity with corporations who know him	100
Popularity with corporations not knowing him	0
Oratory	10
Sociability	60
Tractibility under party domination	2
Willingness to admit defeat	0
Influential friends	5
Support from his colleagues	?
Average	75 to 82

If he is ambitious to do something for his community, his profession, or his country, he knows from long experience with the cold-blooded figures of fact that he cannot be elected over the professionally political Bill or the naturally political Tom; so he stretches the friendship of the old college days to get what he wants through them.

As an individual he is not responsible for these conditions. His college training, his environment, his professional training and his business as a whole are against him. His success as a mining engineer depends upon his experience in various fields. He does not remain in one community long enough to establish a sphere of permanent influence. The people with whom he comes in contact, like himself, are nomadic; a few years finds them scattered to all parts of the globe. The mining engineer is essentially a pioneer, and as such he does not want to settle down. He thinks at times he would like the quiet, steady life of his business brother, but when he tries it he does not stay. He must be conquering Nature and solving Nature's problems. If he were not so he would not be an engineer.

But more particularly the engineer knows, when he aspires to political honors, he is not going to be backed up by his profession. It has not been organized on that basis. Its principles and its precepts in the past have been "each individual for himself." There has been no collective thought or action to further his interests or his business. While miners and muckers, hoistmen and mechanics, even the unskilled laborers, organized for collective bargaining with organized capital, our engineers, our technical societies, and our technical press decried the idea of keeping pace. It was not included in the ethics and was beneath the dignity of engineers to organize in anything resembling a union, as engineers are the direct representatives of Capital, and as such cannot place ourselves on a par with Labor. We must not limit the amount a skillful engineer might earn by adopting a minimum scale of fees or salaries, regardless of how little compensation the struggling youngster of our profession was getting.

The result has been that many of the younger members have dropped from mining and taken up more lucrative lines of endeavor. Some of these men have gone into politics, but naturally they have entered in their new roles and not as engineers. Yet withal, the outlook is not hopeless. The war brought the mining engineer into prominence for his efficiency and executive abilities and gave him some encouragement. Some of the profession who did not stay with mining too long are notable exceptions to the rule. The Governor of Nevada is a mining engineer. Several of the important commissions of this and other states have engineers at their heads or as members. It would be interesting if the *Journal* could inform us as to the number of engineers acting as city managers.

This last medium of dragging the engineer into the limelight is the greatest opportunity we have for ultimately producing the "engineer-politician." As city manager he has full and unrestricted outlet for his technical ability, and, with his usual inborn desire to get to the bottom of things, generally will assimilate the qualifications necessary for election to public office.

These individual instances, the more liberal tendency of the technical journals so noticeable of late, and, most important of all, the consolidation of the Engineering Societies to gain recognition of the engineer as a *human being*, are great strides in the right direction. Now let us start propaganda in our technical schools for more liberal training in sociology, literature and general culture, and the engineer will lead the world.

F. DEAN BRADLEY.

Goldfield, Nev., Aug. 26, 1919.

"Wildcat" Oil Wells

To those not familiar with the terminology of the oil industry the expression "wildcat" oil well carries with it, but not justly, a suggestion of opprobrium. In mining, a "wildcat" proposition usually is more than an unreliable or an unsafe speculation; an insinuation of dishonesty is more often than not intended in the use of the expression. This is generally not the case with oil wells. The New Standard Dictionary (Funk & Wagnalls) gives as one meaning of the term "wildcatter," "one who drills for oil where it is not known to exist." By deduction one obtains the definition of a wildcat well as one that is drilled, or being drilled, where oil is *not known* to exist. This is vastly different from drilling where it is *known not* to exist. Therein lies the difference between a speculation, or gamble if you will, and the obtaining of money under false pretenses. In general, the wildcat oil well is merely one drilled in territory where no oil has been found, whether there are any indications of success or not.

Gulf, Tex., Aug. 17, 1919. ALBERT G. WOLF.

Further Tests With Coke and Powdered Coal at Copper Cliff

In the *Journal* of Sept. 13, reference is made to the experiments on the application of pulverized coal in the blast furnaces at the smeltery of the International Nickel Co., of Canada, Ltd. The text you published has, unfortunately, given many interested parties the impression that the company's experiments have been unsuccessful, particularly as you state "it is probable that the work connected with same will soon be terminated." I have just returned from a visit to Canada, and wish to correct impressions that have been made. It is true that in the experiments recently carried out in an effort to smelt copper-nickel ores without coke the results have not been encouraging. However, it has been demonstrated that a combination of the use of coke and powdered coal is practicable, and the following comparative results obtained from two furnaces of the same size, with the same furnace charge and blast pressure, over a period of six days, will show the possibilities from an economic point of view:

	No. 7 Furnace Coal and Coke	No 8 Furnace Coke Only
Ore, tons	2,802	3,023
Charge tons	3,013	3,188
Coke, tons	225	411
Coal, tons	192	...
Total fuel, tons	417–13.8%	411–12.9%
Fuel cost	$4,869	$6,370
Fuel cost, per ton ore	$1.74	$2.11

The cost of grinding the coal and the extra labor connected with the coal feeders would be about $0.07 per ton of ore, which would make the fuel cost per ton of ore for No. 7 furnace, operated with the fuel combination, $1.81.

The data at present at hand do not offer much encouragement that the furnaces at this smeltery may be operated on coal alone, but it is possible that a means may be found to overcome the difficulties encountered. The smelting of Copper Cliff ores has always been a difficult problem, and it is gratifying that the combination coal and coke method has accomplished so much, and will undoubtedly be considered by all engineers and metallurgists interested in the subject as being distinctly encouraging.

I might state that though it is true that experiments have been terminated at this time on the basis of replacing all the coke, it is intended, after constructional changes in the furnaces have been effected, to resume experimental work, with a view to obtaining the best results possible on a combination of fuels.

W. L. WOTHERSPOON,
General Manager, Garred-Cavers Corporation.

43 Exchange Place, New York, Sept. 20, 1919.

Can a Geologist Explain?

There are twenty-two creeks and gulches in the Barkerville area of British Columbia that are, or were, rich placers. They flow in every direction except south, even southeast and southwest. In other words, not one rich south-flowing creek has been found in that area in fifty-eight years, although every well-situated, south-flowing creek has been prospected. Cariboo schists, striking approximately northwest and southeast, underlie all of the creeks mentioned, no matter what their direction of flow.

There is no simple and easy explanation, such as gradient too steep or too flat, or course of the creek along the strike of the rock, or mushy bedrock. Apparently, the south-flowing creeks should be as rich as the others, but the gold, in quantity, is not there. In the area mentioned, this is the rule without exception. I would like to know why. Also, does the rule hold good in other northern districts? Who can tell us about the Klondike, Alaska, and Siberia? Does any particular direction of flow indicate a poor placer creek in Australia or South America? If so, why? If not, we come back to the original problem: why are the south-flowing creeks of Cariboo so ornery?

HENRY BOURSIN.

Ozone Park, N. Y., Aug. 30, 1919.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

War-Minerals Act Does Not Cover Ferromanganese

Producers of ferromanganese do not come within the purview of the War-Minerals Relief Act, according to an opinion just handed down by the Attorney General. The opinion was asked in connection with the claim of $561,346.62 by the Anaconda Copper Mining Co. for losses sustained in producing and preparing to produce ferromanganese. In his opinion the Attorney General said in part:

The sole question for determination is whether Congress intended to pay for losses not only incurred in mining manganese but also in manufacturing manganese into an article of commerce known as ferromanganese.

The only uncertainty that could possibly exist as to the meaning of the statute appears to arise out of the word "produce," which is applicable to both mining and manufacture, and mine owners as well as manufacturers are referred to in the statutes as producers. There are, however, certain provisions of the act which definitely limit the application of the word to mining operations.

The claim of the Anaconda Copper Mining Co. evidently is based upon the contention that ferromanganese is an intermediate metallurgical product of manganese and is embraced within the provision for payment of losses to producers by reason of the specific mention of intermediate metallurgical products in the act of Oct. 5, 1918, and the adoption of the minerals enumerated in the law of Oct. 5 in the first paragraph of Section 5 of the act of Mar. 2, 1919. There is, however, no basis for this contention, as the intermediate metallurgical products, metals, alloys, and chemical compounds covered by the act are all specifically named, and, as there is no reference to ferromanganese, the rule of law *expressio unius exclusio alterius* applies.

The Attorney General upholds his conclusions by a careful review of the discussion while the measure was the subject of legislative consideration and of the conference reports.

The Tariff Situation

In the opinion of Senator Penrose, of Pennsylvania, the chairman of the Committee on Finance, the proper time to consider tariff revision would be after the Presidential election. He further declares that he is opposed to piecemeal tariff legislation, such as is being conducted by the House of Representatives, as it is certain not to deal fairly with all interests concerned.

Senator Penrose expects to call his committee together in the near future, with the purpose of reaching a decision as to the action which the committee will take toward the emergency tariff bills which have been passed by the House and are now before it. It is expected that the committee will support Senator Penrose in his stand, which seals the fate of the tungsten, zinc, and chemical glassware bills, so far as separate legislation is concerned. Those bills have been before the Senate committee for some time, and their friends have made every effort to move the Senate committee to action.

The matter of a general revision in the tariff is not regarded with enthusiasm by any of the Republican leaders. They feel that world conditions are in a state of change and must reach a more stable status before intelligent action can be taken. Many are of the opinion that the enactment of a general anti-dumping bill would protect American interests until it is possible to form a better conception of international trade relationships.

Any specification of all scientific instruments in one group, with a single rate of duty applying to all articles in the group, should be avoided, in the opinion of the U. S. Tariff Commission, which has reported on the subject at the request of the Committee on Ways and Means. These instruments are of such extremely varied character that the most widely divergent competitive conditions exist. To attempt to group them together would result in conspicuous inequities. In the case of certain instruments not now manufactured nor likely to be manufactured hereafter in this country, the Tariff Commission declares, a tax on consumers without stimulation of domestic production would result.

The study made of the situation by the Tariff Commission develops that in many cases articles now are being produced in the United States which are superior to those formerly imported.

Gold and Silver Production

Gold production during the calendar year 1918 shows a decrease of $15,104,000 as compared with the production of 1917. Silver output during 1918 was less than that of 1917 by 3,930,223 ounces. Final figures for the 1918 production, by states, have been issued in a joint statement by the Bureau of the Mint and the U. S. Geological Survey. The statement is as follows:

GOLD AND SILVER PRODUCTION OF THE UNITED STATES
(Gold, Value; Silver, Fine Ounces)

	Gold		Silver	
	1917	1918	1917	1918
Alabama	$2,200	$700	.....	2
Alaska	14,671,400	9,424,700	1,207,164	802,743
Arizona	5,180,600	5,583,000	6,962,257	6,831,465
California	20,929,400	16,784,400	2,107,107	1,432,812
Colorado	15,974,500	12,724,700	7,291,495	6,900,266
Georgia	6,500	4,500	.....	45
Idaho	754,800	701,400	11,402,542	9,396,009
Illinois	.....	.....	7,116	8,218
Maine	.....	700	.....	6,338
Maryland	.....	.....	538	164
Michigan	.....	.....	684,225	516,294
Missouri	300	60	63,344	42,214
Montana	3,673,200	3,280,700	14,555,034	16,378,263
Nevada	6,932,500	6,700,440	11,217,654	9,931,969
New Hampshire	.....	.....	.....	691
New Mexico	1,085,400	687,080	1,535,807	773,662
North Carolina	10,800	4,400	590	100
Oregon	1,687,300	1,265,700	172,152	129,150
South Carolina	1,700	.....	.....	.....
South Dakota	7,372,900	6,699,400	190,382	161,232
Tennessee	5,500	5,600	106,975	105,829
Texas	100	20	587,945	579,158
Utah	3,522,100	3,153,000	13,360,905	13,492,555
Vermont	100	1,000	403	4,891
Virginia	1,300	400	4,500	1,814
Washington	488,200	333,800	266,112	300,000
Wyoming	3,700	900	3,400	1,255
Continental U. S.	$82,304,500	$67,356,600	71,727,6476	7,797,139
Philippines	1,446,100	1,290,000	12,715	13,000
Porto Rico	100	100	.....	.....
Total	$83,750,700	$68,646,700	71,740,362	67,810,139

Gold production in fine ounces in 1918 was 3,320,784, compared with 4,051,440 in 1917.

The Institute Session on Mine Taxation

CHAIRMAN ALLEN opened the session on Monday at 11 a.m. He introduced the subject of mine taxation by giving two definitions of a mine, namely, the commonly accepted designation, "A mine is a wasting resource," and a new definition which demands careful consideration, "A mine is *a manner of wasting resource.*" The underlying thought in the latter is of special interest in the consideration of the subject of mine taxation, particularly in connection with the principles of depreciation and depletion. It is found that the allowance for depletion is not a simple problem that can be solved by assuming a fixed annual reduction in the value of the ore reserve, because of constantly varying conditions, both as to the changing economic operating problems and the irregular changes in the present value of the reserve as a result of current development of new orebodies.

The chairman introduced L. C. Graton, of the Internal Revenue Commission, who addressed the meeting and presented the results of the commission's study of over 35,000 mines which had been valued for taxation purposes by the Bureau of Internal Revenue. Mr. Graton requested co-operation and suggestions from mining men, and the discussion which followed served to indicate some important features of taxation which had not been fully covered by the work of the commission.

R. V. Norris discussed the question from the coal-mining company's point of view and expressed the belief that all coal operators would co-operate with the Government in every possible way to help solve the mine-taxation problem and that they regarded Mr. Graton's works as highly illuminating. He insisted that the commission should recognize a distinction between metal mining and coal mining, in that the latter was more like manufacturing, and should be so regarded.

W. O. Hotchkiss, of the Wisconsin Geological Survey, pointed out the importance of a carefully selected personnel on the commission and expressed the hope that the Government would provide adequate compensation, so that able students and investigators of the mine-taxation problem could be retained until their important work was completed.

Paul Armitage, of New York, discussed the problem from the lawyer's standpoint and offered examples to show that the depletion method, as contemplated by the law to be consistent, must take into account the his meaning by considering the elements of time and value as co-ordinates and pointing out that be a curve falling either above or below a straight line. He believed that the Treasury rule must be changed.

Dedication of Pittsburgh Experiment Station of Bureau of Mines

PITTSBURGH CORRESPONDENCE

DEDICATORY ceremonies of the U. S. Bureau of Mines Experiment Station at Pittsburgh began Monday, Sept. 29. with Van. H. Manning presiding. The attendance at the ceremonies was large and representative. The invocation was delivered by S. B. McCormick, Chancellor of the University of Pittsburgh, and was followed by an address of welcome by Mayor E. V. Babcock. Response to the latter was made by First Assistant Secretary Vogelsang, who represented Frank K. Lane, Secretary of the Interior. Governor William C. Sproul, in his speech, promised co-operation between state and Federal organizations and employees, and announced his intention of introducing radical proposals, during the next legislative session, which would tend to make mining communities more inviting. J. Parke Channing, representing H. V. Winchell, president of the American Institute of Mining and Metallurgical Engineers, discussed the present unrest in metal mines.

Other speakers emphasized the work being done by the Bureau for the conservation of life and natural resources. A number of references were made by speakers to the late Dr. J. A. Holmes, who was the first director and originator of the Bureau of Mines.

After luncheon a special train was provided. and visitors were taken to the experimental mine at Bruceton, where a mine explosion was shown and other experimental work was demonstrated by members of the Bureau.

September Mining Dividends

Dividends paid by 28 United States mining and metallurgical companies in September, 1919, amounted to $11,080,134, compared with $23,553,456 paid by 36 companies in the corresponding month last year. Canadian, Mexican and South American companies paid $1,760,664.

Yukon Alaska Trust, a holding company, made its usual disbursement of $1 per share ($203,433).

Interesting features this month were the resumption of dividends by Calumet & Hecla, which had not paid since December, 1918, and by Ahmeek, Isle Royale, and Osceola, which passed their last quarterly payments. Calumet & Arizona increased its payment from 50c. to $1 per share, and Federal Mining & Smelting, preferred, reduced from $1 to 50c. Among the Canadian companies, Hedley passed its dividend, and Kerr Lake, though it did not pay its regular dividend, made a capital distribution of $1 per share, as a result of reducing its capital stock from $3,000,000 to $2,400,000.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	$1.00	$200,000
Am. Sm. and Ref., com	U. S.-Mex	1.00	609,980
Am. Sm. and Ref., pfd	U. S.-Mex.	1.75	875,000
Argonaut, g	Calif.	.05	10,000
Bingham Mines	Utah	.25	37,500
Caledonia, l. s	Ida.	.01	26 050
Calumet & Ariz., c	Ariz.	1.00	642,520
Calumet & Hecla, c	Mich.	5.00	500,000
Chino, c	N. M.	.75	652,485
Copper Range, c	Mich.	.50	197,500
Cresson Cons., g	Calif.	.10	122,000
Eagle & Blue Bell, l.s	Utah	.05	44,658
Fairview Round Mountain, g.s	Nev.	.02	19,048
Federal Min. & Sm., pfd	U. S.	.50	60,005
Golden Cycle, g	Colo.	.03	45 000
Hecla, l.s	Ida.	.15	150,000
Homestake, g	S. D.	.50	125,580
Isle Royale, c	Mich.	.50	75,000
Kennecott, c	....	.50	1,393,053
Nevada Con., c	Nev.	.37½	749,790
Oroville Dredg., g	Calif.	.12	82,380
Osceola, c	Mich	1.00	96,157
Quincy, c	Mich.	1.00	110,000
Ray Con., c	Ariz.	.50	788,580
St. Joseph Lead	Mo.	.25	352,369
So. Hecla, l.s	Utah	.15	39,457
Tintic Standard, l.s	Utah	.08	93,400
United Eastern, g.s	Ariz.	.07	95,410
United Verde, c	Ariz.	1.50	450,000
Utah Copper	Utah	1.50	2,436 735

Canadian, Mexican and South American Mines	Situation	Per Share	Total
Cerro de Pasco, c	So. Am.	$1.00	$898,224
Kerr Lake, s	Ont.	1.00	600,000
Mexico Mines of El Oro, g.s	Mex.	1.44	262,440

The totals for the first nine months of the year are as follows, the 1918 figures being given in parentheses: United States mining and metallurgical companies, $72,547,069 ($129,402,031); holding companies, $1,113,438 ($1,718,438); Canadian, Mexican, Central and South American companies, $12,163,034 ($14,070,925).

Chicago A. I. M. E. Meeting

Session on "Milling and Industrial Organization" Held At Congress Hotel, Sept. 22—Reduction of Labor Forces, Physical Examinations and General Welfare Authoritatively Discussed

CHICAGO CORRESPONDENCE

THE A. I. M. E. session on "Milling and Industrial Organization" opened on Monday, Sept. 22, at 2 p.m., with F. K. Copeland presiding. The paper on "Chilean-Mill Practice at the Portland Mill," by Luther W. Lennox, was introduced by George M. Taylor, general manager of the Portland mine and mills, at Victor, Col. Mr. Taylor reviewed briefly the investigations made by Mr. Lennox, and pointed out the increased efficiency resulting from a readjustment of the crushing practice at the Portland mills. The paper was discussed by R. B. T. Kiliani, of Denver, Col., who referred to Miami practice, and by C. H. Benedict, of the Calumet & Hecla Mining Co., who commented on methods of crushing employed in the Michigan copper district.

The papers on "Graphic Metallurgical Control," by H. M. Merry; "Mill Operations at the United Eastern During 1917-1918," by Wheeler O. North, and "Crushing Practice at New Cornelia Copper Co.," by W. L. Du Moulin, were read by title, and discussion was postponed. The three papers by Charles F. Willis, namely "Methods of Curtailing Forces at the Copper Queen," "Educational Methods at the Copper Queen," and "Physical Examinations Previous to Employment," were introduced and read by J. W. Reid, who pointed out that the Phelps Dodge Corporation had given careful study to the problem of curtailing forces, and that the salient principle of its present practice was to lay off first those employees who would have the least to lose by such action.

C. H. Benedict discussed the problem of reducing labor forces, and outlined methods employed at Calumet & Hecla properties, where the men are divided into three classes: (a) men with dependents, (b) single men, and (c) returned soldiers. He said that returned soldiers were offered their old jobs in every case, but that in some instances, where the job was filled by a man with a dependent family, the soldier refused to accept the offer and sought employment elsewhere.

The subject of educational methods was discussed by George M. Taylor, who thought that the scheme outlined by Mr. Willis would not be successful in a mining camp like Cripple Creek, Col., where most of the mining operations were carried on by lessees who were more often employers than employees, who were frequently well-educated men, and whose general intelligence was in any event well above that of the average miner.

The paper on physical examinations was elucidated by Mr. Reid, who said that the practice was sometimes resented by labor unions because it was not fully understood. It was pointed out that many miners did not realize that the physical examination was for their own protection, as well as for the purpose of safeguarding the company against liability on account of accidents to men who were physically incompetent to perform the tasks assigned to them. Large mining companies have learned by experience that a man who is physically unfit is almost sure to be hurt sooner or later and is a great liability to the company.

The three papers by Mr. Willis led to a general discussion of the various methods employed by mining companies toward labor uplift and efficiency. A. M. Plum described the "bonus" and "dividend" systems employed in the Platteville, Wis., zinc district for the purpose of increasing tonnage production. Robert Ammon, of Mascot, Tenn., outlined the operation of the "Industrial Democracy Plan" which has been installed in his district, and explained some of the problems involving negro labor wherein it was necessary to limit the individual's earnings in order to maintain efficiency at a maximum. Charles W. Goodale spoke of the "Brawley" system used at Butte, Mont., and stated that a wage of $5.75 per day was sometimes augmented by a bonus as high as $1.25 per day. C. H. Benedict distinguished between "bonus systems" and "profit sharing."

A. I. M. E. Smoker

Program of Entertainment for Visiting Engineers Replete With Novel and Interesting Features—Chu Chin Chow (?) Achieves Sudden And Unexpected Eminence

CHICAGO CORRESPONDENCE

ON MONDAY evening, Sept. 22, 1919, the American Institute of Mining and Metallurgical Engineers held an interesting and entertaining smoker, in the Gold Room of the Congress Hotel, Chicago. Through the untiring energies of Bradley Stoughton, the members of the Institute had the rare privilege of hearing an address delivered by Mr. Chu Chin Chow, an eminent Chinese mining engineer and metallurgist, who, according to his interpreter, spoke of the vast undeveloped mineral resources of China, and the financial and political assistance his country hoped to receive from the United States.

Sidney Smith, cartoonist for the *Chicago Tribune*, supplied mirth in the form of caricatures of members present, and some of their acquaintances.

George S. Rice delivered an illustrated lecture on the present status of the mining industry in the war zones of France and Belgium. Many of the pictures of famous mining plants, before and after the German fiends of destruction had demonstrated their efficiency, served to impress upon the minds of the audience not only the utter lack of sportsmanship of degenerate kultur, but also the herculean labors which confront the French mining engineers who must and will revive their wrecked industries.

Dr. F. G. Cottrell exhibited many interesting war-zone pictures, and described numerous power and industrial projects in Belgium, France, Germany and Italy, not the least interesting of which was a plant in Northern Italy where power was developed by utilizing low-pressure steam of volcanic origin.

One of the features of the evening's entertainment was a one-act comedy which served as a happy vehicle for character sketches of such well-known personages in the mining world as Hoover, Jackling, Rickard, and Hammond. The evening held not a dull moment, for all intervals between main features on the program were appropriated by a male quartet or an orchestra. The members who were present felt truly sorry for those who were not.

BY THE WAY

American Auspices

A bit of British humor may be found in a recent issue of *The Capitalist*, where an officer of the Baku Russian Petroleum Co., (1909) Ltd., is quoted as stating at a company meeting that, "Under the so-called Peace Treaty, just concluded in Paris under American auspices, the new Republic of Azerbaijan—which embraces Baku—was apparently to be recognized by the Great Powers, and the importance of the oil industry as a national asset should eventually ensure its proper treatment at the hands of the new authorities."

A Fuelless Engine

The millenium in engine design has again been achieved, this time in a fuelless engine designed by one C. C. Thorn, of a company that styles itself "The United Powers Co. (when organized), San Francisco." The company purposes renting automatic power of all kinds, including mechanical power, inertia power, leverage power, gravity power, compound power, and hydraulic power. The engine "gets its power from its own energy, developed by its own mechanism without fuel." Three million horsepower on a 40 x 40-ft. tract is possible, it is claimed. The engines work automatically and are always under perfect control. United Powers Co.'s shares are $100 each. "You cannot get too much for a good investment."

Not the Proper Education

A few years ago in a mining town of California it happened that a Cornish mining captain was elected as a member of the local school board. Just before the end of the school term the physics teacher in the high school resigned, and the school board met to elect a successor. As it was so near the end of the term, the board experienced some difficulty in finding a good instructor. Finally, a member of the board suggested the name of a young mining engineer who was employed as assayer at one of the local mines. The qualifications of the young man were discussed at some length, and during the greater part of the conversation Cap'n Frank sat with a look of disgust on his face. When he could hold in no longer he gave vent to his feelings as follows: "Wot! 'E teach physics for we? Wot do 'e naw 'baout un? Why, dam-me, I wouldn't 'ave 'e to doctor a bloody dog for me."

A Grave Situation

An unusual protest against mining operations has recently been made by the people of Oronogo, Mo., against the Oronogo Mutual Mining Co. The latter, it is charged, is mining under the town cemetery. The citizens have held a mass meeting and appointed a committee to investigate. One miner stopped work when he claimed to have discovered that he was mining under his daughter's grave, and others with relatives buried in the cemetery have also threatened to quit. The company admits that it probably will work under the cemetery, although this is not being done at present. It is operating at a depth of 180 ft., and the management points out that no possible damage can be done by mining at this depth. The work is sheet-ground mining, and much powder is being used. The company has a lease from the city council, the members of which argue that the town is poor and the royalty will help in keeping the cemetery in good condition.

Murdered Truth

Hill City, S. D., has a ghost. The manager of the Cowboy mine, Alexander Roy, says so. According to Mr. Roy, the spook manifests itself by giving forth in the mine workings wild screams such as ladies give when they are being choked to death, although at times when it gets tired it growls like a buzzsaw. Mr. Roy has come to the conclusion that the sounds are due to a magnetic vortex caused by a concentration of the earth's magnetism by the metal in the ore. This vortex, according to Mr. Roy, has a form like a smoke ring, or a doughnut, perhaps, and by its whirling gets the air all stirred up, so that it just naturally whirls, too, and makes the sounds described. Study of this phenomenon, according to Mr. Roy, is as valuable as Newton's study of the law of gravitation. If tin can thus centralize magnetic waves, he says, it can be used to overcome the power of gravitation, so that the airship of the future can be built of tin. Mr. Roy evidently has a tin lizzie in mind. It seems, offhand, that the tin market does not require stimulation by ghost stories. As far as the affairs of the Cowboy mine are concerned, a ghost is hardly a live asset.

Leave the Gun at Home

"Speaking of horrors," drawled Britton, as he and the doctor left the change house, "I recall an experience at the Lazarus mine, shortly after graduating. Like many a tenderfoot, I wore a six-shooter. After taking a few samples above the main tunnel level I put my sacks into a larger sack and sealed it, rolling the bundle in my coat and tucking it up on a timber above the winze platform. Descending an old rickety ladder, I was chipping off bits of ore here and there when I was startled by a loud report. Almost instantly came a scream from the level above, followed by the fall of a heavy body that shook the ladder above me. Both candle and hammer dropped from my grasp, and I clung to the ladder to keep from falling. Instinctively I reached to my holster and found it empty. Later it transpired that a drill boy, who had just brought in the lunch of a miner, was attempting to pick the pockets of my coat. As it dawned upon me that it was my own gun that had been fired, I also realized that but a moment before a living person had stood above me. Huskily, I hallooed; but no response came. Lighting matches and holding them over my head, I could make out a huddled bulk sagging over a ladder rung near the top. Calling again to know if help was needed, I could not even see the body move. Bending down to see if anyone below had witnessed the tragedy, I felt a drop of warm liquid strike my neck; and then quite a succession of larger drops. The terrible thought struck me that literally someone's blood was upon my head. A wild notion of flight seized me, but the only outlet was up that single ladder. Mustering my courage as well as I could, I crept tremblingly up. When near the top of the ladder I gently grasped my coat and samples. On the platform I found a perforated dinner bucket, from which the last drops of coffee were dripping. I never inquired about the gun, as I had no further use for it."

PERSONALS

S. K. Dahl has gone to Venice, Cal.

Carl J. Trauerman, well-known mining engineer of Butte, Mont., is visiting in Boston and New York.

Edward Mosehauer, of the United Metals Selling Co., has gone abroad to represent the Copper Export Association with headquarters in Geneva.

Frank A. Kennedy and Edward Collins, of Duluth, Minn., are making several mine examinations in the Seven Devils District in Idaho.

Louis D. Huntoon has resigned as secretary of the Mining and Metallurgical Society of America and is succeeded by F. F. Sharpless.

Preston Locke, of Spokane, Wash., representing the American Smelting & Refining Co., recently visited the Portland Canal and Salmon River districts of British Columbia.

R. H. Crozier, who until recently was mill superintendent of the Hampden-Cloncurry mines, Kuridala, Queensland, has been appointed manager of the ironstone quarry of Burma Mines, Ltd., Namtu, Burma.

Forrest B. Smith, general field representative of the American Mining Congress, spent part of September in San Francisco in the interest of the annual convention of that body to be held at St. Louis, Mo., in November.

Harry S. Denny has been appointed Deputy Civil Service Commissioner for the occupied area of Cologne. Mr. Denny was for a number of years assistant consulting engineer for the General Mining and Finance Corporation.

Adolph Knopf, of the U. S. Geological Survey, has returned to Rochester to complete a survey of the district which he began two years ago, but which was interrupted that he might devote attention to the search for minerals used in the manufacture of munitions.

C. F. Kelley, president of the Anaconda Copper Mining Co., accompanied by John Gillie, manager of mines, and Frederick Laist, general manager of smelteries for the Anaconda, inspected the company's properties at the Boston & Montana reduction works at Great Falls, Mont., recently.

A. H. Lawry, formerly superintendent of the Goldfield Consolidated Mines Co., in Nevada, is now consulting engineer in charge of the Tonopah Divide and other properties controlled by George Wingfield in Divide. Mr. Lawry succeeds William Sharp, who was appointed temporarily after A. I. D'Arcy resigned.

James L. Bruce, general manager of the Butte & Superior, has resigned, effective Jan. 1, 1920, to accept the general managership of the Davis-Daly Copper Co., taking charge of the latter Sept. 15. Mr. Bruce will attend to the affairs of the Butte & Superior up to the first of the year, in addition to his duties at the Davis-Daly.

Captain C. E. Grunsky, Jr., has resumed his engineering work in San Francisco with the C. E. Grunsky Co., a reorganization of the American Engineering Corporation. Captain Grunsky had been with the U. S. Army for two years, during which time he saw active service at the front and supervised the valuation of war losses in French mines.

George W. Metcalfe, general manager of the mines and smeltery at Kennett, Cal., is leaving to take up other work for the United States Smelting, Refining & Mining Co. He will be succeeded by O. J. Egleston, who has been chief engineer for the same company in its Western field. L. D. Anderson, at present manager of smelteries at Salt Lake City for the company, will succeed O. J. Egleston as chief engineer. K. H. Kervin formerly superintendent of the smeltery at Kennett, has gone to the copper refinery at Chrome. Frederick Lyon, managing director, has retired owing to ill health. George W. Heintz, for years local manager at the Salt Lake offices, will be transferred to the Eastern office and his place taken by Clarence E. Allen, who has been manager of mines and is in turn succeeded by D. D. Muir, Jr., formerly local manager of the exploration department and later in charge of the zinc plant at Baxter Springs, Kan.

SOCIETIES

American Iron and Steel Institute will hold its sixteenth general meeting at the Hotel Commodore, New York, Oct. 24 and 25.

American Foundrymen's Association held its twenty-fourth annual meeting in Philadelphia, Sept. 29 to Oct. 3. The various sessions were at the Bellevue-Stratford Hotel, and the exhibition at the Commercial Museums.

Institute of Metals.—At the meeting at Sheffield, England, on Sept. 24 and 25 an additional paper to the original program was presented by Zay Jeffries, of Cleveland, Ohio, on "The Micro-Mechanism of the Ageing of Duralumin." Dr. Jeffries went to England to present his communication in person.

Electric Furnace Association held a meeting in Chicago at the Congress Hotel on Monday, Sept. 22, the day before the meeting of the American Electrochemical Society. There was a business session in the morning, for formal reorganization, election of officers and other important business. Following a luncheon, a general session for the afternoon was arranged, to which were invited all who are interested in the electric furnace and its products.

Engineers' Club of Northern Minnesota resumed the regular monthly meetings at the public library in Hibbing on Sept. 20. The members were entertained by a film of the General Electric Co. showing the electrification of the Chicago, Milwaukee & Puget Sound Ry. A committee was appointed to investigate the merits of the electric shovel as applied to Mesabi Range operations, and also to study the practicability of changing the present steam shovels to fuel-oil burners.

INDUSTRIAL NEWS

The Western Electric Co. has recently opened a branch, consisting of a sales office and warehouse, at 334 East Bay St., Jacksonville, Fla. The house is in charge of A. H. Ashford. Electrical supplies and specialties will be carried in stock.

New Jersey Zinc Co. has sent out a statement on the use of rolled zinc for making stencils, and detailing its advantages over other materials. Negotiations are being carried on to supply Japanese producers with zinc stencils for stamping silk designs to replace the hand methods now practiced.

International Exposition of Mining Industries will open in the Grand Central Palace, New York, on Dec. 1, instead of on Oct. 15, as originally planned. Howard R. Ward, manager, has returned from an extended tour through mining centers, to prepare for the opening. Failure to have the quarters ready for occupancy by the exposition is the reason for delay, the building having been used by the Government.

Colburn Flotation and Engineering Co., Denver, Col., has issued an illustrated circular describing the Colburn vacuum flotation machine. A number of advantages are claimed for the machine, which, it is stated, uses both mechanical and air agitation without the cost and complication involved in compression of air outside the machine. Also, it is said that the vacuum may be varied according to the ore. One valve regulating the sand discharge from the last spitzkasten is the only regulating valve used.

American Ore Reclamation Co., 71 Broadway, New York, has issued a 24-pp. pamphlet describing the operations of the company, which is engaged in the licensing and engineering of plants for the sintering and desulphurizing of iron-bearing material, and acts as consulting engineer in operations involving the treatment of iron-ore material that can be beneficiated by sintering. The company operates principally under the Dwight & Lloyd patents for continuous down-draft sintering and is also licensed to use the intermittent process with separate tilting pans, the Heberlein, the up-draft process, and the rotary kiln.

EDITORIAL CORRESPONDENCE

Current Events and Topics in Brief Of Interest to Engineers And Operators

GLOBE, ARIZ.—Sept. 25

The American Association of Engineers has just organized a Globe-Miami Chapter with fifty-one members. C. P. Griffith is temporary chairman and R. L. Russell is temporary secretary.

"Safety-First Week," will be observed Oct. 19 to 25 under the auspices of the Globe-Miami District Mine Rescue and First-Aid Association, which will aid in extension of its work to cover civic features outside of the mines. This will include household and street accidents, fire, industrial accidents and school education along safety lines.

The Salt River Valley Water Users' Association is to build a steam-power plant near Phoenix, to equalize the service from its hydro-electric plants at Roosevelt and valley points. The Inspiration Consolidated Copper Co. has been getting an irregular power supply from the Roosevelt dam works and has had to rely to a large degree on its own steam-power service, supplemented from the reverberatory furnaces of the International smeltery. Now it is understood there is to be guaranteed a steady power supply from the Roosevelt system. In addition, there is to be connection at Phoenix, with the same system by the Arizona Power Co., from its hydro-electric works on Fossil Creek, Yavapai County.

SALT LAKE CITY, Utah—Sept. 17

Mine Rescue Car No. 11, of the U. S. Bureau of Mines, which has been visiting mining camps of Utah, has been in Salt Lake City at the Oregon Short Line station since Sept. 22, and will remain for two weeks. Classes in first-aid work are being held by the crew of the car.

Commercial Club of Salt Lake City has organized a mining division, so that there may be a group within the club to look after matters of especial interest to the mining industry. A committee of thirty-five mining men has been formed, with John N. Hayes, of the Utah Copper Co., chairman, and Frank Pingree, of the National City Bank, vice-chairman. A. G. Mackenzie was made secretary. At a meeting on Sept. 12, a resolution in favor of lowering freight rates on ores and concentrates from Salt Lake Valley to Eastern refineries was adopted.

The Campaign for Americanization of Foreign Workers in the various mining camps of the state, as provided ance at school on the part of all persons between the ages of sixteen and forty-five, who are unable to read and write the English language, is meeting with success, and those affected are showing themselves anxious to comply with the regulations. At Bingham, a committee of fifty was organized among the foreigners, on which every mine as well as each of the nine nationalities in the camp was represented. This committee has made it a point to reach every person affected by the law, furnishing information as to the requirements, the date of opening classes, and other pertinent facts in connection with the law. School opened Monday, Sept. 22.

JOPLIN, MO.—Sept. 27

Shipping Conditions have greatly improved in the Joplin-Miami district in the last week, following the appointment of Ross A. Blanchard, assistant traffic manager for the American Zinc, Lead & Smelting Co., as representative of operators, smelters, and the U. S. Railroad Administration, with headquarters at Joplin and Miami, in an attempt to relieve the situation. Regional Director B. L. Bush, at St. Louis, promised cars up to 65 per cent of the district's demands, and all the coal cars that could be used, and although Blanchard did not reach the district until Sept. 22, much relief already has been received.

DULUTH, MINN.—Sept. 22

The Bendixen Bill, levying a 5 per cent tax on iron ore, was vetoed by the Governor on Sept. 19 after passing both Senate and House. The vote in the former was 38 to 28. The bill was expected to raise about $6,500,000 a year in taxes.

HOUGHTON, MICH.—Sept. 29

Labor is becoming more plentiful in the Michigan copper district. Many Finnish miners are returning to the mines from the farms, desirous of having underground employment for the winter. Mines are constantly adding to their forces, but putting practically all new employees at work underground, and none on surface. Additions now are made at the rate of 100 a week. This will not increase the output of copper as much as might appear at first glance, because all new underground men are put at development operations, getting the mines ready to better the total output when demand requires it.

The steel strike has no effect on the indirect reflection in the demand for metal. The strike of boatmen also is without effect here, as all mines of this district have their coal supplies on hand to run on full time until July 1, 1920.

The metal situation in the Houghton district is not clearing up. There is 50,000,000 lb. of copper on hand. The Lake Superior smelting plant, a subsidiary of the Calumet & Hecla, at Dollar Bay, closed last June, and still has 15,000,000 lb. on the dock, unsold. No new mines reopened this week.

A gift of a life insurance policy to every employee was announced on Sept. 29 by Calumet & Hecla, Osceola Consolidated, Ahmeek, Allquez, La Salle, Lake Milling, Smelting & Refining, Superior, Isle Royale and Whitepine companies, employing eleven thousand men. The policies range from $1,000 to $1,500, payable to any named beneficiary, dating Oct. 1, 1919, without medical examination and without cost to the recipient. The miners, who have always had to pay high rates for life insurance, are jubilant.

ISHPEMING, MICH.—Sept. 27

Drilling for Iron Ore Near Escanaba will be undertaken by a company recently organized at that city. Some exploration work was done there years ago. The contract has been awarded to E. J. Longyear Co. Escanaba is not considered to be on any of the Michigan iron ranges, but is the shipping port for the Menominee Range. If ore is found it will be considered to be an extension of the eastern Menominee Range.

Titles of Lands of the Ayer Estate, of Boston, are being searched by attorneys representing the Chicago Title & Trust Co., and it is reported that the lands are to be sold en bloc. The Ayer estate has large holdings in Houghton, Ontonagon, Iron, and Gogebic counties, in northern Michigan, some of which are in the mineralized belts. If the deal goes through it will be the largest transfer of lands to take place in the Lake Superior district in several years.

The Steel Workers' Strike is having its effect in the Lake Superior district, but it is difficult to state at this time what the extent of the curtailment in the district will be. Some of the train and shovel crews were laid off during the first week, operators not caring to load boats that they fear may not be unloaded when they reach lower Lake ports. If the seamen decide to

region will be seriously handicapped, although a strike at this season would not result as disastrously as one earlier in the year. The time is fast approaching when Lake shipments stop for the year, and the seamen have little to gain if they do decide to go out in sympathy with the steel workers. No mines have been closed as yet, although the managers of two Mesabi Range operations have been advised from the East that they may have to suspend operations on short notice. However, all of the open-pit mines will be closing for the year within a month or six weeks. The Minnesota Steel Co. is operating its plant at West Duluth, the men having decided to remain at work. There are no strikes anywhere in the entire Lake Superior district, the ore-dock and coal-dock workers, who were idle for a few weeks, having gone back to work. The United States Steel Corporation has been preparing for labor troubles for several months. Though the independents have been slow in getting ore down to Lake Erie, the Corporation has ben stocking ore at its furnaces.

HOUSTON, TEX.—Sept. 25

Crown Oil & Refining Co., at annual meeting of stockholders, held Sept. 15, elected the following officers: George E. Colvin, president; J. W. Colvin, vice-president; H. F. Montgomery, secretary; and C. F. Robinson, treasurer. Directors are: R. L. Young, J. C. Stribling, George E. Colvin, J. W. Colvin, all of Houston, and J. W. Dubould, W. D. Ahern, and F. S. O'Reilly, of New York. Reported that refinery now under construction at Pasadena will be completed by Jan. 1, 1920, with capacity of 5,000 bbl. daily, and that, contrary to reports, this refinery will not be sold.

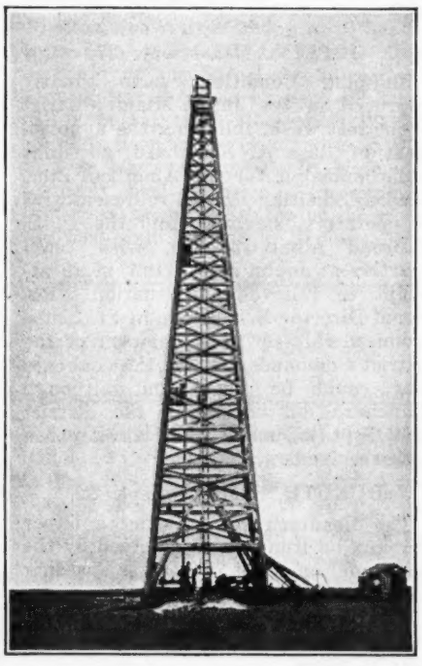
Eagle Petroleum Co., of Houston, has been recently organized. Officers are J. A. Reynolds, president, C. E. Morgan, vice-president and general manager; C. E. Gates, secretary and treasurer. Company has purchased Swastika lease of fifteen acres in Markham field, Matagorda County, upon which are three producing wells; Swonger & Vicar lease, at Batson, Hardin County, where two wells are producing and a third will be drilled at once; and leases at Stratton Ridge, Brazoria County; High Island, Galveston County, and in the Homer field of Louisiana. Company is a close corporation, with no stock for sale.

BIRMINGHAM, ALA.—Sept. 25

The Opening Day of the Steel-Workers' Strike found the plants of the Birmingham district practically untouched. Approximately 500 men in the entire state responded to the walkout orders. The Steel Corporation's subsidiary, the Tennessee Coal, Iron & Ry. Co., lost about 70 men at its big Fairfield plant, 30 or 40 at the By-Products, and fewer than 150 at the steel plants in Ensley. Fewer than 150 men are said to have left the American Steel & Wire Co.'s mills.

All plants in Bessemer are running, and few strikers are to be seen on the streets. The opening of the strike found all mines along the southern end of Red Mountain operating with their normal Monday crews. In some places the force was below normal, but this was later found due more to the "Monday-after-payday" effect than to the strike. It is understood the Muscoda mines, one of the principal mining properties of the Tennessee Coal, Iron & Ry. Co., has more than doubled its force of deputies and watchmen. The plant of the Anniston Steel Co. at Anniston, Ala., which employs more than 300 men, and that of the Gulf States Steel Co. at Gadsden, were not affected at all by the strike.

It is expected that the union leaders in the Birmingham district will call for a sympathetic strike. It is to be noted that some of the companies are putting men back to work who struck but have asked for reinstatement. The independent companies expect to be drawn into the struggle soon. The employees of the Woodward Iron Co. have already been ordered out, but have made no response.



DERRICK 112-FT. HIGH AND ROTARY DRILLING RIG AT 3,000-FT. OIL WELL MATAGORDA COUNTY, TEXAS

In the face of severe criticism, Governor Kilby, of Alabama, and his followers succeeded in passing the bill providing for a tax on coal and iron ore. The companies in the Birmingham district and elsewhere in the state made every effort to prevent its passage, but without success.

Rail is being rolled at the steel mill of the Tennessee Coal, Iron & Ry. Co., at Ensley, Ala., for shipment to Japan, and a dozen or more flat cars were spotted on Sept. 22 to be loaded. The order, it is understood, calls for a large tonnage.

NEW YORK—Sept. 26

Phelps Dodge Corporation intends to launch a campaign of intensive underground development work at its Morenci property, and, at a later date, will probably erect a modern concentrator which can treat to advantage low-grade copper ores. Various new installations and equipment will be necessary in connection with the mining of these ores and their beneficiation, but, it is stated officially, absolutely no definite plans have been made as yet. Such plans will be developed in the course of the next six months.

BOSTON—Sept. 27

Arizona Commercial Mining Co., of Globe, Ariz., again brought same suits, under Massachusetts laws, against Iron Cap Copper Co., also of Globe, immediately after the Massachusetts Supreme Court in equity session had handed down a decision that the two suits were beyond its jurisdiction. These last actions, however, were suits at law and disregarded the finding of the court in equity session. In brief this means that the cases will be now tried by a court and jury and a decision finding for either the plaintiff, with damages, or for the defendant will be handed down.

WASHINGTON, D. C.—Sept. 25

The Anglo-Persian Oil Co. is negotiating to effect a complete absorption of five Scotch mineral-oil companies, according to a consular report from London to the Bureau of Foreign and Domestic Commerce. The Scotch companies which will be affected by this transaction are the Pumpherston, Broxburn, Oakbank, Young's Paraffin Light & Mineral Oil Co., and James Ross & Co., having an aggregate capital of approximately £2,860,000. The Anglo-Persian company will undertake to supply the Scotch companies, it is stated, with enough crude oil for refining, so that they can return an ample dividend to their shareholders, and the directors of these concerns are urging the stockholders to accept the proposal of the Anglo-Persian company.

TORONTO, ONT.—Sept. 27

The Mines of Cobalt are gradually getting back to normal, following the cessation of the strike. In the majority of cases, however, the lower workings are still flooded, but within the next week or so all the properties should be working at capacity. Owing, no doubt, to the fact that a considerable number of men are rustling, there is a decided increase in the efficiency of the men.

About a week ago the miners of the Kirkland Lake district took a vote as to whether or not the strike in that camp should be called off. So far, the result of the vote has not been announced, but it is probably that the strike will cease, and work be resumed. If work is not started soon, the probabilities are that all the properties will remain closed until next spring.

THE MINING NEWS

Progress of Mining Operations
Condensed and Classified
For Easy Reference

ARIZONA

Cochise County

Central (Dos Cabezas) — Development begun on sixteen copper claims. Group adjoins Mascot. E. A. Ely in charge.

Centurion (Dragoon)—Cleaning up drifts, and shaft preparing to operate after two-year shutdown.

Middlemarch Copper (Gleason)—Closed for several weeks on account of miners' strike for higher wages. Will start work with new force soon.

Arizona United (Johnson)—Voluntarily raised wages 10 per cent Sept. 1.

Greenlee County

New Year's Gift (Duncan)—Compressor being installed.

Maricopa County

Eyrich (Phoenix)—Free-milling ore sampling over $12 developed to extent of 9,000 tons in 300-ft. shaft and 300 ft. of drifting. Main exploration will be on 500 level. Property in Winifred district, eighteen miles north of Phoenix. John F. White manager.

Abe Lincoln (Wickenburg)—Work resumed with three shifts after several weeks' shutdown. Shipments being made.

Dragon (Wickenburg) — Fifty-ton mill to be started soon on gold-silver-vanadium ore. Shaft to be deepened from 260 ft. to 1,000 ft. About 2,000 ft. of underground development already done. Operated by Los Angeles company, headed by James G. Scarborough.

Pima County

Vulcan (Tucson)—Sold to William Kemp and associates, of New York. Property, in San Xavier district, has been held by W. R. Ramsdell, Epes Randolph, Charles Walker and James N. Pemberton.

Yavapai County

Gadsden (Jerome)—Closed down for repairs.

United Arizona (Jerome)—Completed timbering of main shaft to 875 level and installing new hoist. Property in Black Creek district, thirty miles from Jerome. Operated by Phoenix company, headed by C. H. Dunlap.

Verde Squaw (Jerome)—Second diamond-drill hole caved at 330 ft., after passing through 15 ft. of well-mineralized schist.

Hidden Treasure (Prescott)—Property in Groom Creek section, under development by Jerome company, headed by C. H. Bennett, of Clarkdale. J. H. Morrison, mine manager.

Tuscumbia (Prescott)—Old silver bonanza in Bradshaw Mountains being put in condition by Jerome company, headed by George Kingdon, manager. of United Verde Extension. New surface equipment being installed.

Yuma County

Ranier (Salome)—Two-compartment shaft down 80 ft. New hoist and compressor equipment being installed. William T. Gnash in charge.

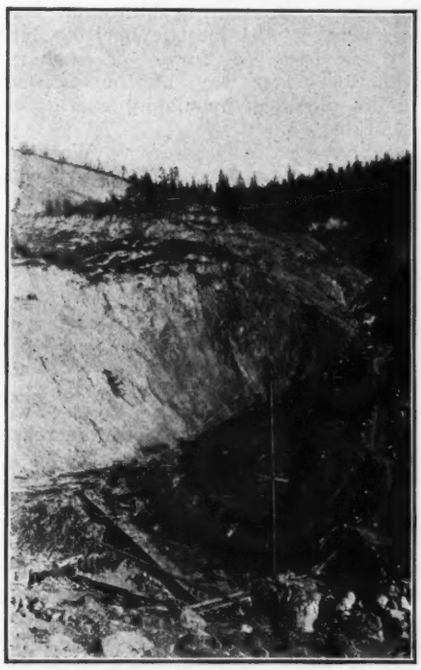
New King of Arizona (Yuma)—Lower-grade ores to be worked in new mill. Operation made possible by development of water, impounded near mine, in Castle Dome mountains.

ARKANSAS

Marion County

Beulah (Rush)—Under lease to Arkansas Zinc Co. Sinking shaft to 51-ft. level, where zinc ore has been proved by drilling. Now down 14 ft.

Mattie May (Rush)—Small force of miners at work on property. Mill completed.



LA GRANG HYDRAULIC MINE, TRINITY COUNTY, CAL., NOW CLOSED DOWN

North Star (Yellville)—Will start active mining and milling operations at once.

Independence County

Polk-Southard (Batesville) — Independence Mining Co. operating Polk-Southard manganese mine, has produced since May 31 800 tons of high-grade boulder ore, averaging 50½ per cent metallic content. Shipments of this made on last year's contract.

CALIFORNIA

Amador County

Keystone (Amador City)—Preparations nearly completed for operation on large scale. Wooden timbers in upper part of shaft being replaced by concrete, which is expected to eliminate expense caused by settling ground around shaft. Hoisting equipment being overhauled.

Central Eureka (Sutter Creek)—Twenty-five stamps of forty-stamp mill now in operation. Development work confined principally to 3,700 south drift, which is 81 ft. from shaft and contains 5 ft. of quartz averaging about $17 per ton. Restraining dam for impounding tailings being enlarged and strengthened.

Calaveras County

Triple Lode Gold (Angels Camp)—Old Blair gold-quartz mine, idle for sixteen years, to be operated by new California company, headed by T. L. Brophey. Hoist installed at old shaft, and former workings being unwatered.

Finnigan (Carson Hill)—Bonded by James R. Keith Co., of San Francisco. Old mill dismantled and site selected for new mill. Property adjoins Morgan mine.

Kern County

Rand Silver Con. (Randsburg)—Persistence of high-grade contents proved to 75-ft. depth by uncovering of third rich streak at this depth. Width of new shoot 5 ft. Crosscutting begun at 50-ft. level, where second high-grade pocket was found. Lessees working in six different places. Deepest shaft 80 ft.

Modoc County

High Grade (Alturas)—Acquired by Lester Reynolds, who will operate during winter.

Nevada County

Alta Hill (Grass Valley)—Roy King has taken option on fifteen parcels of land noted in past for yielding placer gold, but which show no quartz outcrops. Undertaking based on geological study of district. Development planned by tunnels.

Idaho Maryland (Grass Valley)—Deed of conveyance recorded transferring holdings of Union Hill mines to Idaho-Maryland Mines Co. Sale includes all claims and machinery.

Placer County

Rising Sun Con. (Colfax)—Electric power line under construction from sub-station at Colfax. Pumps and hoists installed, and unwatering of shaft has reached point between second and third levels.

Plumas County

Walker Copper (Portola)—Hauling concentrates to railroad in four 5-ton trucks. Mill capacity increased to about 200 tons per day. Concentrates run from $8 to $12 per ton in gold and silver, in addition to copper contents. Right of way secured for aërial tramway, to reduce shipping expense.

Walker Consolidated (Portola) — Property adjoining Walker Copper mine and including Alta-Alice group of claims to be prospected by two diamond-drilling outfits.

Sierra County

York Finney (Downieville)—Bonded by James F. Hunt, former district attorney, who plans to unwater shaft and drift north and south on gold-quartz vein.

Hilo (Sierra City)—Bernhardt Brothers waiting for rain to wash large amount of gravel stored on dumps.

COLORADO

Hinsdale County

Golden Fleece (Lake City)—Mill being overhauled and re-equipped for flotation. Dump will be re-treated. Concentrates to be shipped to Salida.

Sulphuret M. & R. (Lake City)—Extending tunnel to connect with old shaft to improve ventilation. When completed will develop on larger scale. At present shipping small tonnage of $50 silver-lead ore.

Ouray County

Revenue Tunnel (Ouray)—A. S. & R. Co., lessee, has let four development contracts and ordered 10,000 ft. of timbers. J. Gordon Hardy, consulting engineer.

Yankee Girl (Ouray)—Hoisting silver copper ore from famous old chimney. Acid water on lower levels hindering reopening.

Saguache County

Rawley (Bonanza)—Owners will operate mine, which has been idle since 1912. Property has large amount of $20 ore blocked out.

Summit County

Laurium (Breckenridge)—Blue Flag Gold Mining Co., of Cripple Creek district, cleaning out old workings of Laurium group, in Illinois Gulch. Property recently visited by J. F. Erisman, president.

Warrior's Mark (Breckenridge)—To be operated after long idleness by Warrior's Mark Mining Co., recently incorporated by Samuel Klous, of Boston, County Treasurer George Robinson, and County Assessor William Keogh.

Teller County

Acacia Gold (Cripple Creek)—Has resumed sinking South Burns shaft on Bull Hill from 1,450 level to 1,550 level. Will crosscut at latter depth to Shurtloff vein.

Caley mill (Cripple Creek)—Property on Iron Clad Hill being dismantled by Morse Machinery Co., of Denver.

KANSAS

Joplin-Miami District

Miami Zinc & Royalty Co. will build mill on Wauchessette lease west of Treece, Kan. Property good producer with hand jigs. Company operating Oko mine, south of Picher. W. H. Tylee, of Boston, president, and T. F. Lennan, of Joplin, vice-president and general manager.

Silver Fox (Baxter)—New mill, replacing one destroyed few months ago by fire, almost completed.

Oberman (Jefferson City, Mo.)—Sinking shaft on ground leased from Wright estate, recently purchased from A. E. Bendelari and others. Tract has been well drilled.

Andrew Bros. (Joplin)—Empire tailings mill purchased and being moved to Wyandotte lease, at Galena.

High Five (Joplin)—Has completed sinking of new field shaft and connected it with mill by tramway.

Union Metals (Joplin)—Sinking of No. 8 shaft begun at Waco property. No. 7 shaft virtually completed.

MICHIGAN

Copper District

Calumet & Hecla (Calumet)—Operating two shafts two shifts daily on Osceola lode and all shafts two shifts daily on Calumet conglomerate. Building new railway from Ahmeek direct to stamp mill is being discussed. Experimenting with electric smelting, but not successfully. Survey of smeltery situation under way, but no decision as to extent of rebuilding operations at Hubbell plant.

Wolverine (Kearsarge) — Working two shafts, Nos. 3 and 4. Eight lower levels producing good copper. Operations back of foot wall in upper levels satisfactory.

Lake (Lake Mine)—Michigan shareholders favor resumption of operations. Sixteen facings in copper rock when work was suspended. Sufficient men for basis of new crew residing at property.

White Pine (White Pine)—Two shafts now working, and crew increasing steadily.

Gogebic Range

Mines on Gogebic Range made record shipments recently when 200,000 tons of ore was forwarded to Ashland docks in three days.

Village of Wakefield will soon vote on proposition to incorporate as a city. Limits would be established so as to include Wakefield Iron Co. and Plymouth open pits, as well as several underground mines. May mean increased taxes for mines concerned.

Newport (Ironwood)—"K" shaft sunk and station cut on 26th level, where development work will soon begin.

Oliver (Ironwood)—Mines began to stock again Sept. 25. Condition probably temporary and owing to lack of boats at Ashland docks rather than to steel workers' strike.

Pabst (Ironwood)—Hoar loading machine ordered for power plant for loading coal from dock into cars. Cars trammed to elevator at boiler house, raised to top of coal bins, run over automatic weighing machine, and dumped. Seven 150-hp. return-tubular and three 400-hp. water-tube boilers in two batteries, former supplying hoists and compressor, latter turbo-generators.

Plymouth (Wakefield)—Drifting continued at 125-ft. depth in drainage shaft sunk from bottom of pit. Only two shovels working in ore.

Marquette Range

Cliffs Shaft (Ishpeming)—Good progress being made with new concrete shafthouses. Expected to be completed before cold weather. Will be first of this type on range. Quarter million tons of ore in stock will be carried over.

Mary Charlotte (Negaunee)—Half of crew of 150 miners of Breitung Hematite mine transferred here. Over 350 now working at Mary Charlotte. All ore in stock to be shipped.

MONTANA

Silver Bow County

Anaconda (Butte)—August copper output of Washoe and Boston & Montana smelteries 12,600,000 lb., compared with 11,122,000 lb. in July and 10,530,000 lb. in June. Scarcity of experienced miners reported. Company speeding up on development work.

NEVADA

Clark County

Yellow Pine (Goodsprings)—On Sept. 1 management voluntarily raised wages of muckers, trammers and laborers 25c. per day to $4.75. Miners, machine men, timbermen and millmen received 50c. per day advance.

Esmeralda County

Atlanta (Goldfield)—Deep workings being abandoned and pumps pulled from main Atlanta winze from 1,750 level. Winze and 1,750 level will be allowed to fill. Future work in Atlanta will be done from 1,465 level of Grizzly Bear.

Mineral County

Candelaria (Mina)—An eight-drill Chicago pneumatic compressor shipped to Candelaria, and accommodations for force will be built at once.

Nye County

Louisiana Con. (Tybo)—Contract for surveying and installing transmission line from Manhattan to Tybo, to furnish power for mine and smeltery, let by Nevada-California Power Co. F. W. Draper manager of the Louisiana Consolidated.

White Pine County

Boston & Ely Con. (Ely)—Stockholders on Sept. 10 voted to sell property and assets of Ely Northern Copper Co. to Boston and Ely Consolidated Mining Co. for $77,445. Transaction completes merging of Boston Ely, Smoky Development Co., and Ely Northern Copper.

McEllin (Hamilton)—Fifty-ton concentrator, being built by Sayers and Tilford, lessees, to treat dump, almost completed. Estimated dumps contain 80,000 tons which will run $12 per ton.

NEW MEXICO

Grant County

Hanover-Bessemer (Fierro) — Shut down on account of steel strike; 300 men affected.

OKLAHOMA

Joplin-Miami District

American Z. L. & S. (Joplin)—Has taken working option on forty-acre lease south of St. Louis, Okla., and has several drills at work.

Rialto (Miami)—Purchased by E. S. Warner, of Buffalo, Mo. Will be operated after year's idleness. Situated south of Picher camp.

Niangua (Picher)—Followed recent purchase of Hare mine on adjoining lease with purchase of Diamond Joe mine, northwest of Quapaw. Building underground hopper at latter plant, which will be known at Niangua No. 3. Henry Medlin, of Miami, manager.

Vantage (Picher)—Annual election of officers resulted in naming Dr. C. D. Clapp, of Moberly, Mo., president; W. C. Cole, Bethany, Mo., vice-president; W. W. Innis, Miami, Okla., secretary-treasurer; R. P. Sharpe, Miami, director and general manager.

TEXAS

Brazoria County

West Columbia Field Production for second week in September reported approximately 36,000 bbl. daily.

Hurricane at West Columbia destroyed eleven derricks and did considerable other damage on Sept. 14.

Eastland County

Gulf Production (Pleasant Grove)—Oil well brought in unexpectedly night of Sept. 13 was ignited. Difficulty expected in smothering fire.

Harris County

Operations at Humble Field: Syrian-American Oil Co., No. 4 McDonald, abandoned; Texas Co., testing 178 Herman at 1,250 ft., and abandoned No. 28 Koehler 2,420 ft.; Brazos Oil & Refining Co., abandoned No. 5 Fuller well.

Jefferson County

Deep Wells at Spindletop now drilling are Texas Co., No. 1 Fee, 2,400 ft. deep, and No. 2 Fee, 2,200 ft.; Wilson & Broachi, No. 1 Green, 2,100 ft.; Crown Oil & Refining Co, No. 1 McFadden, starting to drill.

Liberty County

Big Four Oil (Hull)—Brought in No. 5 Hannicker well at 2,570 ft., flowing 25 bbl. daily by heads.

Hull Field Production second week in September about 2,600 bbl. daily. Recent completions: Big Four, No. 5 Hannicker well; Humble Oil & Refining Co., No. 1 Palmer; and Gulf Production Co., No. 1 Thomas.

Matagorda County

Texas Co. (Markham)—No. 6 Meyers well making heavy gas pressure from 3,100 ft.

Texas Gulf Sulphur (Gulf)—Hurricane Sept. 14 destroyed three derricks.

Allen Texas (Matagorda)—Derrick on No. 1 Baer well at Big Hill destroyed by hurricane Sept. 14. Drilling may not be resumed.

UTAH

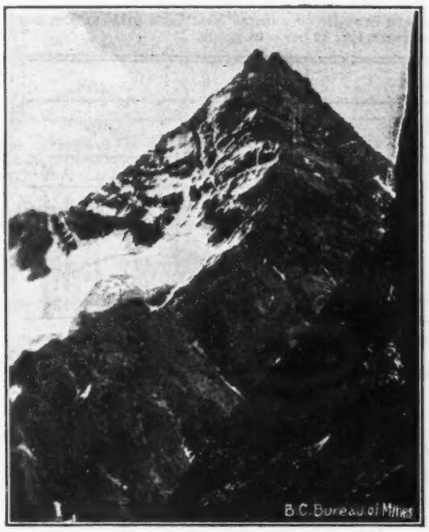
Juab County

Lehi Tintic (Eureka)—Board of directors elected: George Nicholls, president: W. H. Trask, vice-president; C. D. Anson, G. B. Doyle, J. A. Barclay, and Charles Zabriskie, manager.

Sioux Con. (Silver City)—At meeting of Knight mining companies held in Provo, Sept. 10, taking over of this property announced.

Salt Lake County

Little Cottonwood Transportation (Alta)—Has increased rates, beginning Sept. 15, with permission of Public Utilities Commission, all increases



MOUNT NELSON FROM SITTING BULL CABIN, WINDMERE MINING DIVISION, BRITISH COLUMBIA

asked by company having been granted except in case of low-grade ores, for which increase of 30c. per ton allowed, instead of $1, as proposed.

Monetaire Mining (Alta)—Suit filed by N. V. Jones against board of directors—D. J. Williams, president, M. H. Kriebel, Paul Platt and Mrs. M. A. Williams—and Monetaire Mining Co., to declare void alleged action of board in appropriating $14,000 as president's salary for seven years back and in levying assessment of 1c. a share. Conspiracy to defraud alleged.

Bingham & Garfield (Bingham Canyon)—Restraining order asked by Col. E. A. Wall, to prevent company from constructing tracks across Klondike, Starless, Keystone, St. Patrick, and Sarsfield claims, owned by him, interference with extraction of ore deposits from claims being alleged as ground for suit.

Utah Copper (Salt Lake City)—Company has invited employees to select representative committee of three to consult with management on subjects of mutual interest.

CANADA

British Columbia

Cork-Province (Slocan) — R. H. Stewart, mining engineer, has recommended expenditure of $100,000 as necessary to insure continuous ore supply, also that shaft be deepened and equipped, that more power be developed, that drifts and raises be driven on new level, and possibly additions be made to mill.

Boston-McCrea (Boston Creek)—Electrically driven mining plant will be installed.

Coniagas (Cobalt)—Now treating 225 tons of ore and 250 tons of tailings daily.

La Rose (Cobalt)—Has found high-grade ore in vein at No. 3 shaft of University. Workings now being dewatered.

Mining Corporation (Cobalt)—Developing gold property in Cariboou district, British Columbia.

Nipissing Extension (Cobalt)—Has taken over old Farrar property. Company capitalized at $3,000,000. A. J. Young, of Northern Customs Concentrators, president.

Green-Kirkland (Kirkland Lake)—Camp buildings erected and twelve men engaged in prospect work.

Murray-Mowgridge (Larder Lake)—Shareholders have ratified deal to reorganize by selling assets to new company called Murray-Mowgridge Mines, Ltd., in consideration of 1,928,870 shares of new company. New York interests have agreed to underwrite 200,000 shares of stock, with which to wipe off existing obligations, completing purchase price on certain properties, and furnishing funds for development. Property being developed on 200 level, and shaft will be continued to 300 level.

MEXICO

Baja California

Boleo (Santa Rosalia)—August production of copper, 1,597,040 lb.

Sonora

Nacozari Con. Copper (Douglas, Ariz.)—Deep development and drainage tunnel advanced approximately 200 ft. monthly during last three months, with formation showing almost continuous network of small seams of chalcopyrite, with bornite streaks at intervals. General formation now showing monzonite and rhyolite porphyry. Main breast now 3,900 ft. from portal and within 300 ft. from oxidized outcrop. Moderate tonnage of $300—$400 silver ore coming from San Pablo mine. San Pablo drift will soon connect with San Pablo working shaft, thus providing drainage and ventilation. Company's wagon road to Nacozari now in good condition for auto truck.

BELGIAN CONGO

Katanga (Elisabethville) — August production of copper, 5,026,488 pounds.

THE MARKET REPORT

Silver and Sterling Exchange

Sept.	Sterling Exchange	Silver		Sept.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
18	414½	113⅞	61¾	22	414¼	114½	62⅛
19	415¾	114⅜	62	23	415½	115⅜	62⅜
20	415	114½	62	24	417	116⅞	63

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Daily Prices of Metals in New York

Sept.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot	N. Y.	St. L.	St. L.
18	21¾@22¼	55	6.25	5.95	7.10@7.15
19	21¾@22¼	54¾	6.15@6.25	5.95	7.10
20	21½@22	55½	6.15@6.25	5.95	7.05@7.10
22	21½@22	54	6.15@6.25	5.95@6.00	7.05@7.10
23	21 @21½	53½	6.15@6.25	5.95@6.00	7.00
24	20½@21	53½	6.25	5.95@6.00	6.95@7.00

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis. Tin is quoted on the basis of American tin, 99 per cent grade.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M.		Spot	3M.	Spot	3 M.	Spot	3 M.
18	101	101¾	110	286	278¾	25⅝	26¼	41¾	42⅛
19	100¾	101¼	110	281	275½	25⅝	26⅜	41¾	42½
20	....	....	...	....	....	...	...	...	...
22	100¼	100¾	110	278½	273½	25½	26	41½	42
23	100	100¾	110	276½	273½	25⅝	26	40¾	41¾
24	99¾	100¼	110	277	274¾	25⅝	26⅛	41½	42¼

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Metal Markets

New York—Sept. 24, 1919

The predominant feature in all of the metal markets this week was the steel strike, the coming of which was clearly foreseen for several days before the event. Under this influence, there were further recessions in the price for copper, spelter, and tin.

Copper

About the same conditions prevailed as in the previous week, except that prices were lower. There was the same differential of about ¼c. per lb. between wire bars and ingot bars. Big producers did no business. They received some inquiries from consumers, with intimations that the latter would not pay the producers' price, but would pay something above the market price established by the smaller agencies and brokers. The principal producers, however, refused to entertain such overtures.

A small tonnage of copper was sold for export to Germany.

Copper Sheets—The base price of copper sheets is 33½c. per lb. Demand strong. Copper wire is quoted at 26@26½c. in carload lots, f.o.b. mill. Market is dull.

Tin

The approach of the steel strike inspired tinplate manufacturers to refrain from buying, and in some cases to offer tin for resale. This precipitated a sharp decline. At the beginning of the week Straits was quoted at 56¼@56½c. At the close, business was done at 54c.

Lead

Some pretty good business was done by those producers who had prompt lead available, and in general they realized the full price for it. However, some rather large business was done at a sharp concession by one manufacturer who had a good buyer. There is still a considerable quantity, estimated at about 2,500 tons of lead, for sale by second-hands, but to a considerable extent this is in out-of-the-way markets. For example, a considerable tonnage of lead in Boston was offered at 6c., and relatively low offers were made on lead at Baltimore and Cleveland. Though the quantity of second-hand lead in this market appeared to be small, if it existed at all, producers selling from the refineries in the New York district had to meet the competition of second-hand lead from places like Hartford.

Zinc

A small business was done from day to day at declining prices, but the aggregate was small. The steel companies requested postponement of deliveries, and brass manufacturers had no interest in buying. The demand for high-grade zinc was as dull as for Prime Western.

Zinc Sheets—The quoted price of zinc sheets is $10.50 per 100 pounds.

Aluminum—Virgin metal quoted at 33c. per lb. No change. Market quiet.

Antimony—The market continued quiet and unchanged at 8½ and 8¾c. for spot. Futures were quoted lower, 8¾ and 9c. being mentioned.

Bismuth—Unchanged at $2.96.

Cadmium—Unchanged at $1.40.

Nickel—Ingot, 42c.; shot, 43c.; electrolytic, 45c.

Quicksilver—The advance continued, and $109 was reached and maintained for a day or two, the market then receding to $105. This probably occurred under the influence of the expected arrival of 500 flasks of Italian quicksilver from Genoa. San Francisco telegraphed $102, steady.

Silver—Owing to the large and incessant demand on China account, silver has advanced rapidly, during the last week about 3c. per ounce, and closes firm at the highest price prevalent in a long time.

Mexican dollars at New York: Sept. 18, 87¾; Sept. 19, 88⅜; Sept. 20, 88¼; Sept. 22, 88¼; Sept. 23, 89⅜; Sept. 24, 90¼.

Platinum—This market continued to be excited. The metal is in strong demand and the supply is scarce. We quote refined ingot at $130 and $140.

Palladium—Unchanged at $120.

Chrome Ore—No business reported.

Manganese Ore—No business reported. The ideas of the buyers and sellers are far apart.

Molybdenum Ore—No business reported.

Tungsten Ore—There was no change in the situation.

Joplin, Mo., Sept. 20.—Zinc blende, high, $47.20; basis 60 per cent zinc, premium, $43.50; Prime Western, $42.50; fines and slimes, $40@$37.50; calamine, basis 40 per cent zinc, $30@$26. Average settling prices, blende, $43.09; calamine, $28.22; all zinc ores, $42.76. Lead, high, $71.15; basis 80 per cent lead, $70@$65; average selling price, all grades of lead, $66.84 per ton.

Platteville, Wis., Sept. 20—Blende, basis 60 per cent zinc, $43.50 for premium grade and $42.50 for Prime Western grade. Lead ore, basis 80 per cent lead, $70 per ton.

Pig Iron—Prices unchanged.

Steel—No market. Prices are quotable unchanged.

THE MARKET REPORT

Daily and Weekly Metal and Mineral Prices
Metal Market Conditions, Average
Monthly Prices, Stock Quotations

Silver and Sterling Exchange

Sept.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Sept.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
25	420	118⅜	63⅜	29	423	117	62½
26	424	119½	63⅜	30	417½	118⅞	64
27	426	118¾	62⅝	Oct. 1	418	119	64

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy-ounce of sterling silver, 925 fine.

Daily Prices of Metals in New York

Sept. Oct.	Copper Electrolytic	Tin Spot	Lead N. Y.	Lead St. L.	Zinc St. L.
25	21 @21¼	53½@53¾	6¼	5.95@6.00	6.95@7.00
26	21⅛@21⅜	53¼@53½	6¼	5.95 " 6.00	6.95 " 7.00
27	21 @21¼	53¼@53½	6¼	5.95 " 6.00	6.95 " 7.00
29	20¾@21¼	53⅞@54	6¼	5.95 " 6.00	6.95 " 7 00
30	21 @21¼	53⅞@54	6¼	5.95 " 6.00	6.85 " 6.90
1	21 @21¼	53⅝@53⅞	6¼	5.95 " 6.00	6.85 " 6.90

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis. Tin is quoted on the basis of American tin, 99 per cent grade.

London

Sept. Oct.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3M.	Lead Spot	Lead 3 M.	Zinc Spot	Zinc 3 M.
25	100¼	100¼	110	277	274¾	25⅝	26⅛	41½	42⅛
26	102	101½	110	277½	275¾	25⅝	26¼	41	41¾
27	....	....	....	....	....	....	....	....	....
29	101	100½	110	272	270½	25⅝	26⅛	41	41⅜
30	102¼	101½	110	274½	272½	25⅝	26⅛	40¾	41½
1	103	101½	....	274½	272½	25⅝	26⅛	40¾	41½

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Metal Markets

NEW YORK, Oct. 1, 1919.

The market this week was dull and uninteresting. However, it began to appear as if there might be some of the skies in the copper situation.

Transatlantic freights were again easier without there being any change in quotations. Freight to Hamburg could be arranged at $13, and to French and Dutch ports at $10. To British ports $15 was asked, but probably $12.50 could be done. An embargo on shipments to England by American boats was put into effect Monday noon, but British boats continued to sail. The rates from San Francisco to Hongkong and Kobe remain at $20.

Lucien Nachmann has joined the copper sales department of the American Smelting & Refining Co. Mr. Nachmann is a thorough expert in the metal selling business. He was in New York from 1890 to 1905 as representative of Brandeis, Goldschmidt & Co., and from 1905 to 1915 was in London as a partner in the same house.

The War Department reported on hand, as of Sept. 10, the following stocks of Metals: Brass((70-30), 79,-207 tons; Brass (60-40), 28,636 tons; total brass, 108,311 tons; copper, 363 tons; pig lead, 1,000 tons; zinc, 10,820 tons.

COPPER.

Another week passed without the big producers doing any business, but the smaller agencies did a little. Copper continued to be offered from second-hands, but the supplies seemed to be greatly reduced, and ingot bars were no longer offered at such relatively low prices as previously. One small sale to Germany was reported, and one domestic consumer placed a million-pound order. All of the big producers received more inquiries from domestic consumers, and that fact in itself was regarded as encouraging.

TIN

Business was dull during the early part of the week, but was better on Monday and Tuesday of this week. However, the market went off today on some lower offers from London. This was rather surprising, in view of the opinion entertained in some quarters that the strike in Great Britain would check the shipment of tin from there.

In the early part of this week spot Straits was quoted in this market at 55c., but at the close it was offered at 54½c., with the intimation that 54⅜c. might be done on a fifty-ton order.

Singapore quoted £276½, c. i. f., London, on Sept. 26; £279½ on Sept. 29; and £280 on Sept. 30.

LEAD.

The market was rather dull, although some fair business was done on certain days. Every producer was firm in demanding 6¼c., New York. Some business was done around 6c., this representing the cleaning up of some speculative holdings. Cheap lead is still offered at points outside of New York, including Boston, but a good deal of this is strategically misplaced. A consumer buying at those prices and paying the freight to where he wants to use the lead is apt to find it rather costly, after all. Such experiences have been reported. On the other hand, speculative transactions might have different results.

The mines of the Coeur d'Alene continue closed, with the exception of the Bunker Hill and Sullivan.

The St. Joseph Lead Co. has not yet resumed smelting at Herculaneum, but expects to do so within a few days. The Doe Run brand of refined lead will be produced again, and will be offered at a premium of $4 per ton over ordinary lead.

ZINC.

There was scarcely any buying by consumers. On the contrary, producers in general were in receipt of requests to defer shipments. This

was but natural, in view of the steel strike. On the part of the brass manufacturers the liquidation of the immense stock of brass held by the Government is going to throw a shadow over the markets, including that for spelter. Such buying of spelter as there was this week was mainly of speculative character.

Antimony—The market was quiet. We quote spot at 8½c., and futures at 9@9½c. The Chinese and Japanese houses are not at all keen about selling, their expectations being for higher prices.

Quicksilver—The market was quiet at $105, with a fair demand and an absence of selling pressure. San Francisco telegraphed $99.

Platinum—The market was more quiet, with quotations unchanged at $130@140 for refined ingot.

Palladium—Unchanged at $120.

Chrome Ore—Quoted at 80c. per unit, delivered at Eastern works.

Manganese Ore—Quoted nominally at 50c. per unit, c.i.f., Baltimore.

Molybdenum Ore—Quoted nominally at 75c. per lb. of molybdenum sulphide.

Tungsten Ore—The situation remains unchanged. No business was reported and no quotations were mentioned. One buyer offered $7 per unit, which price was regarded as too low.

CONDENSED FORM:

Copper Sheets—33½c. per lb. Demand strong. Wire, 25½@26½c. Market weak.

Zinc Sheets—$10.50 per 100 lbs.

Aluminum—33c per lb.

Bismuth—Unchanged at $2.96.

Cadmium—Unchanged at $1.40.

Nickel—Ingot, 42c.; shot, 43c.; electrolytic, 45c.

Pyrites—Spanish pyrites is quoted at 17½c. per unit for furnace size ore, free from fines, c.i.f. New York or other Atlantic ports. Sulphur companies reported to be selling at prices as low as 14@15c. Market unsettled.

Silver—The silver market continues firm. China continues to be the main support to the market. Shipments from San Francisco during August are reported as 9,900,000 oz.

Mexican dollars at New York: Sept. 25, 91¾; Sept. 26, 91¾; Sept. 27, 91⅛; Sept. 29, 89¾; Sept. 30, 91⅛; Oct. 1, 91⅛.

PITTSBURGH—Sept. 30.

The iron and steel strike started yesterday week, Sept. 22, and candid iron and steel manufacturers now admit they expected a somewhat larger one than occurred. Taking the industry as a whole, about 35 per cent of the men struck at the outset, and then there were various rearrangements. Where any large number of men at a plant or in a district struck, they intimidated the rest and got them out; where only a few struck they went back to work. For two days the decreases in employment exceeded the increases, and then for two days more there was an even balance. By Friday morning more men were going back than were going out. Districts closed tightly were the Mahoning Valley, Cleveland (not including Lorain), and the Wheeling district, the Calumet district (Chicago and Gary) going down more than half, the South and East being scarcely affected, Johnstown and Buffalo, however, closing almost entirely.

Municipal Pittsburgh was little affected; the Monongahela Valley, an important part of the Pittsburgh district, developed 25 to 35 per cent unemployment, and the Shenango Valley 40 to 50 per cent. The Monongahela and Shenango Valleys at once became pivotal points, and developments there were watched narrowly, it being regarded from the outset as certain that if these districts would hold for the manufacturers Youngstown and other districts would eventually yield. After three or four days, conditions in the two valleys began to improve, and the improvement has continued to date. It is almost positively assured that the strike is a failure, but, taking the industry as a whole, the increase in employment from the low point is a small percentage and the increases in tonnage production is small, and Cleveland, the Mahoning Valley and the Wheeling district are closed as tightly as at any time, and resumption there may possibly be a matter of many weeks. There is no trustworthy information available here as to late developments in the Calumet district.

Pig iron and steel production, on the whole, is at a lower proportion to capacity than is employment. The strike is of course considered from the point of view of employment, not that of tonnage output. It is of minor consequence to the manufacturers how much they produce, and as to consumers, they have shown a remarkable spirit of co-operation, and, much as they would like to have deliveries, they are making no complaints. Producers are endeavoring to distribute their output in such manner as to give the widest employment among their customers. Shipments are no greater than production, if as great.

Pig Iron—As the strike is one of common labor almost exclusively, the blast furnaces are harder hit than the steel producing and steel rolling mills, and some steel mills have had production curtailed by shortage of pig iron as well as strike within the mill. As so many merchant furnaces are situated far from the centers where the strike is strongest, the total merchant furnace output makes a good showing, and pig iron is not likely to be made especially scarce. This analysis is confirmed by the continued good demand for foundry coke; furnace coke has gone begging. The Mahoning Valley furnaces are all down, but in the Shenango Valley four of the six at Sharpsville, all down at one time, are now operating; two at West Middlesex were not closed, and the scattered western Pennsylvania furnaces are in most cases operating. Market quotations are unchanged: Bessemer, $27.95; basic, $25.75; malleable, $26.25@27.25; foundry, $26.75; forge, $25.75, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh.

Steel—There is approximately an even balance between closing of mills that produce and that consume billets and sheet bars. Prices remain: Billets, $38.50; sheet bars and small billets, $42; slabs, $41; rods, $52.

Ferromanganese—One or two English producers are quoting $95, c.i.f., for 80 per cent ferromanganese, the majority being out of the market. It is thought in trade circles that one or two will always be in the market. Before the complaint of "dumping" made before the Federal Trade Commission, nearly all the English producers were quoting. Hearings on the complaint thus far have not been public. Domestic producers continue their quotation of $110, delivered. There is no demand.

Coke—Shipments of furnace coke on many contracts have been suspended on account of the strike. Operators endeavored to meet the situation by drawing ovens less frequently, but coke accumulated and has been offered at $4 or less without finding takers. One buyer bid $3.25. Foundry coke has been in excellent demand, and prices are if anything stiffer, fairly good grades commanding $6.25 in open top cars and $6.50 in box cars, per net ton at ovens, Connellsville region.

NEW YORK—Oct. 1, 1919.

Buying has been checked but not suspended by the iron and steel strike, according to Iron Age. Bookings are chiefly with the furnaces and mills not seriously affected.

The continued favorable progress of the strike is all that the producers expected. Where protection is sufficient to prevent intimidation workers are returning. Much encouragement is taken from the refusal of the Bethlehem employees to go out and from the conditions in the pivotal Monongahela Valley. The continued absence of marked rioting, usually a sign of a collapse, points to a drawn-out issue.

Following the 30,000 tons of basic iron reported last week, the American Bridge Co. has closed on 15,000 tons more. The basic market is now stronger at $1 per ton above the basis of these sales. Fresh inquiries for about 10,000 tons of foundry iron for next year have appeared in New England. The Middle West is taking iron from western Pennsylvania, involving an added freight cost.

Plate mills willing to take on further commitments have no difficulty in getting 2.65c., Pittsburgh, though 2.55c. was quoted on 4,800 tons for Japan.

The scarcity of steel bars, for months in demand, is putting activity in bar iron, and advances for prompt shipment are not unlikely.

Producers remain firm in their determination to shut down mills if it is not safe to run them, and consumers are expressing an unqualified support. It remains that without relief in thirty days the automobile industry will begin to feel the pinch.

Prompt blast-furnace coke is lower, due to an accumulation at ovens.

THE MINING INDEX

Listing Special Articles of Interest
And Value to the Miner
And Metallurgist

This index is a convenient reference to the current literature of mining and metallurgy published in all the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

474—ALASKA—Mineral Resources of the Western Talkeetna Mountains. Stephen R. Capps. (U. S. Geol. Surv., Bull. 692-B; 18¼ pp., illus.)

475—CEMENT COPPER BRIQUETTES, Water and Chlorides in. Edward Keller. (Bull. A. I. M. E., Sept., 1919; 4¼ pp.)

476—CHILE—El Trabajo i la Vida en el Mineral "El Teniente." (Bol. Minero, Soc. Nacional de Mineria, April and May, 1919; 75 pp., illus.)

477—IDAHO—The I. X. L. Copper Prospect. Robert N. Bell. (Eng. and Min. Journ., Sept. 6, 1919; 2¾ pp., illus.) 20c.

478—LEACHING—Chemical and Electrochemical Problems Involved in New Cornelia Copper Co.'s Leaching Process. Henry S. Mackay. (Bull. A. I. M. E., Sept., 1919; 16 pp.)

479—PRODUCTION of Copper in the United States in 1918. Advance Statement. B. S. Butler. (U. S. Geol. Surv., 6 pp.)

480—QUEBEC—The Huntingdon Copper Mine Quebec. Reginald E. Hore. (Can. Min. Journ., Aug. 6, 1919; 2¼ pp., illus.) 20c.

GOLD AND SILVER—GEOLOGY

481—AUSTRALIA—Geology of the Bendigo Goldfield, Victoria V. Pabst. (Chem. Eng. & Min. Rev., July 5, 1919; 6¾ pp., illus.) 40c.

482—ONTARIO—Matachewan Gold Area. H. C. Cooke. (Can. Min. Journ., July 16, 1919; 5½ pp., illus.) 20c.

GOLD AND SILVER—GENERAL

483—ALASKA—Mineral Resources of the Upper Chulitna Region. Stephen R. Capps. (U. S. Geol. Surv., Bull. 692-B; 25¼ pp., illus.)

484—ALASKA—Mineral Resources of the Western Talkeetna Mountains. Stephen R. Capps. (U. S. Geol. Surv., Bull. 692-B; 18½ pp., illus.)

485—BRITISH COLUMBIA—Taylor Mining Co., Ltd. E. A. Haggen. (Min. and Eng. Rec., July 30, 1919; 22 pp., illus.)

486—CRUSHING—Chilean-Mill Practice at Portland Mill. Luther W. Lennox. (Bull. A. I. M. E., Sept., 1919; 7 pp., illus.)

487—KLONDIKE—The Discovery of the Klondike. Henry Bursin. (Eng. and Min. Journ., Sept. 6, 1919; 2¾ pp.) 20c.

488—MINING METHODS of Alaska Gastineau Mining Co. G. T. Jackson. (Bull. A. I. M. E., Sept., 1919; 24 pp., illus.)

489—ONTARIO—Recent Developments in Wasapika Gold Area. Reginald E. Hore. (Can. Min. Journ., Sept. 10, 1919; 2 pp., illus.) 20c.

490—STATISTICS—Gold Statistics, Wars and Prices. James R. Finlay. (Eng. and Min. Journ., Aug. 30, 1919; 5 pp.) 20c.

IRON ORE DEPOSITS, MINING, ETC.

491—CANADA—The Production of Coal and Iron Ore in Canada, Considered in Relation to the Iron and Steel Industries. (Can. Min. Journ., Aug. 19, 1919; 2½ pp., illus.) 20c.

492—CAVING—Bulkheading Open Stopes. M. E. Richards. (Eng. and Min. Journ., Sept. 13, 1919; 2 pp., illus.) 20c.

493—GERMANY—Germany's Mineral Losses Under the Treaty. (Iron Age, July 24, 1919; 1¾ pp.) 20c.

494—GOGEBIC RANGE—Geology of the Gogebic Range and Its Relation to Recent Mining Developments. W. O. Hotchkiss. (Eng. and Min. Journ., Sept. 13 and 20, 1919; 15½ pp., illus.) To be continued.

495—HYDRO-ELECTRIC PLANT—The McClure Hydro-Electric Plant. (Eng. and Min. Journ., Sept. 13, 1919; 3½ pp., illus.) 20c.

496—MINNESOTA—State-Owned Iron Mines. (Eng. and Min. Journ., Sept. 6, 1919; 1¾ pp., illus.) 20c.

497—SHAFT SINKING—Sinking of the "H" Shaft at the Pabst Mine. A. J. Wagner. (Eng. and Min. Journ., Sept. 20, 1919; 2½ pp., illus.) 20c.

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